AD-A148 305

INSTALLATION RESTORATION PROGRAM
PHASE I: RECORDS SEARCH

ARNOLD ENGINEERING DEVELOPMENT CENTER, (AEDC) Tennessee

Prepared For

United States Air Force
AFESC/DEV
Tyndall AFB, Florida
and
HQ AFSC/DEMV
Andrews AFB, Maryland

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This report identified and evaluated potentially hazardous waste disposal sites at Arnold Engineering Development Center ~~(AEDC)~~, Tennessee. Records of past waste handling and disposal practices at the facilities were reviewed. Interviews with past and present installation employees were conducted to develop a history of waste disposal practices. The environmental setting for the area for effectively receiving the wastes was evaluated including soils, geology, ground water and surface water. Twelve sites at the installation were found to have potential to create environmental contamination. These include a landfill/leaching area, a site with fire protection training/burning/landfill activities, retention reservoir/drainage area, landfill, leaching pit, chemical treatment pond, leach/burn area, testing area, an abandoned water treat-plant, and three surface drainage areas. Follow-on investigations (Phase II) were recommended and outlined.

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EXECUTIVE SUMMARY

The Department of Defense (DOD) has developed a program to identify and evaluate past hazardous material disposal sites on DOD property, to control the migration of hazardous contaminants, and to control hazards to health or welfare that may result from these past disposal operations. This program is called the Installation Restoration Program (IRP). The IRP has four phases consisting of Phase I, Installation Assessment/Records Search; Phase II, Confirmation/Quantification; Phase III, Technology Base Development; and Phase IV, Operations/Remedial Actions. Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I, Initial Assessment/Records Search for Arnold Engineering Development Center (AEDC) under Contract No. F08637 83 G0005 5000.

INSTALLATION DESCRIPTION

Arnold Engineering Development Center is located in Coffee and Franklin Counties, Tennessee, midway between Chattanooga and Nashville. The entire AEDC reservation encompasses some 39,000 acres, of which approximately 3,000 acres are devoted to testing and support facilities.

AEDC was constructed in the early 1950's and the initial testing activities got underway in 1953. The Center has since its beginning conducted a wide range of tests and simulations in aerodynamics, propulsion and aerospace systems.

ENVIRONMENTAL SETTING

The environmental setting data reviewed for this investigation identified the following points relevant to AEDC:

1. The mean annual precipitation is 54.17 inches; the net precipitation is +17.17 inches and the one-year, 24-hour rainfall event is estimated to be 3.1 inches. These data indicate that

there is a moderate potential for precipitation to infiltrate the surface soils. Also, there is a moderate potential for runoff and erosion.

2. The natural soils on the installation are typically well drained loam and combinations of cherty, silty and clayey loam with moderate permeabilities.

3. Surface water, an abundant resource of AEDC, is controlled by underground storm sewers, open ditches, streams and man-made reservoirs.

4. The primary water source for AEDC drinking water and process water is Woods Reservoir which is on the installation. Some small wells serve isolated facilities on the installation with potable water.

5. A shallow aquifer of limited extent and permeability exists locally within 30 feet of land surface. The shallow aquifer is isolated in most places and is not used as a main source of ground water.

6. A shallow confining clay bed underlies the uppermost aquifer and separates it from the deeper Manchester aquifer. The clay bed may be discontinuous in some parts of AEDC and allow ground-water recharge into the Manchester aquifer.

7. The Manchester aquifer, a major confined aquifer of the area is a primary source of ground water for water users of AEDC as well as local farms and municipalities.

8. The shallow aquifer and the Manchester aquifer are dewatered immediately adjacent to the JP-4 vertical rocket test cell and Mark I aerospace chamber due to continuous pumping from sumps around the test facilities.

9. The Chattanooga Shale, a major confining bed of the area, is the lower confining unit for the Manchester aquifer.

10. The Gray Bat is a Federally and State listed endangered species which inhabits the Elk River Dam.

11. AEDC comprises a U.S. Air Force Wildlife Management Area with two Federally listed Natural Areas (Sinking Pond and Goose Pond).

A review of these major findings indicates that pathways for the migration of hazardous waste-related contamination exist. Contaminants present at ground surface would likely be mobilized to local drainage alignments via the shortest flow path. The shallow aquifers present have moderate permeabilities and are isolated in most places from the deeper more important Manchester aquifer by a confining bed of clay. The ground-water movement and contaminants if present in the shallow aquifers would probably favor a horizontal direction toward discharge points in streams and lakes. If the confining bed between the shallow aquifers and the Manchester aquifer is discontinuous, contaminant migration may occur vertically into the Manchester aquifer and follow a horizontal flow path toward pumping centers such as the AEDC test area dewatering wells and local water wells.

METHODOLOGY

During the course of this project, interviews were conducted with installation personnel (past and present) familiar with past waste disposal practices; file searches were performed for past hazardous waste activities; interviews were held with local, state and federal agencies; and field surveys were conducted at suspected past hazardous waste activity sites. Seventeen sites (Figures 1 and 2) were initially identified as potentially containing hazardous contaminants and having the potential for contaminant migration resulting from past activities. These sites have been assessed using a Hazard Assessment Rating Methodology (HARM) which takes into account factors such as site characteristics, waste characteristics, potential for contaminant migration and waste management practices. The details of the rating procedure are presented in Appendix G and the results of the assessment are given in Table 1. The rating system is designed to indicate the relative need for follow-up investigation.

FINDINGS AND CONCLUSIONS

The following conclusions have been developed based on the results of the project teams field inspection, reviews of base records and files, interviews with base personnel, and evaluations using the HARM system.

FIGURE 1

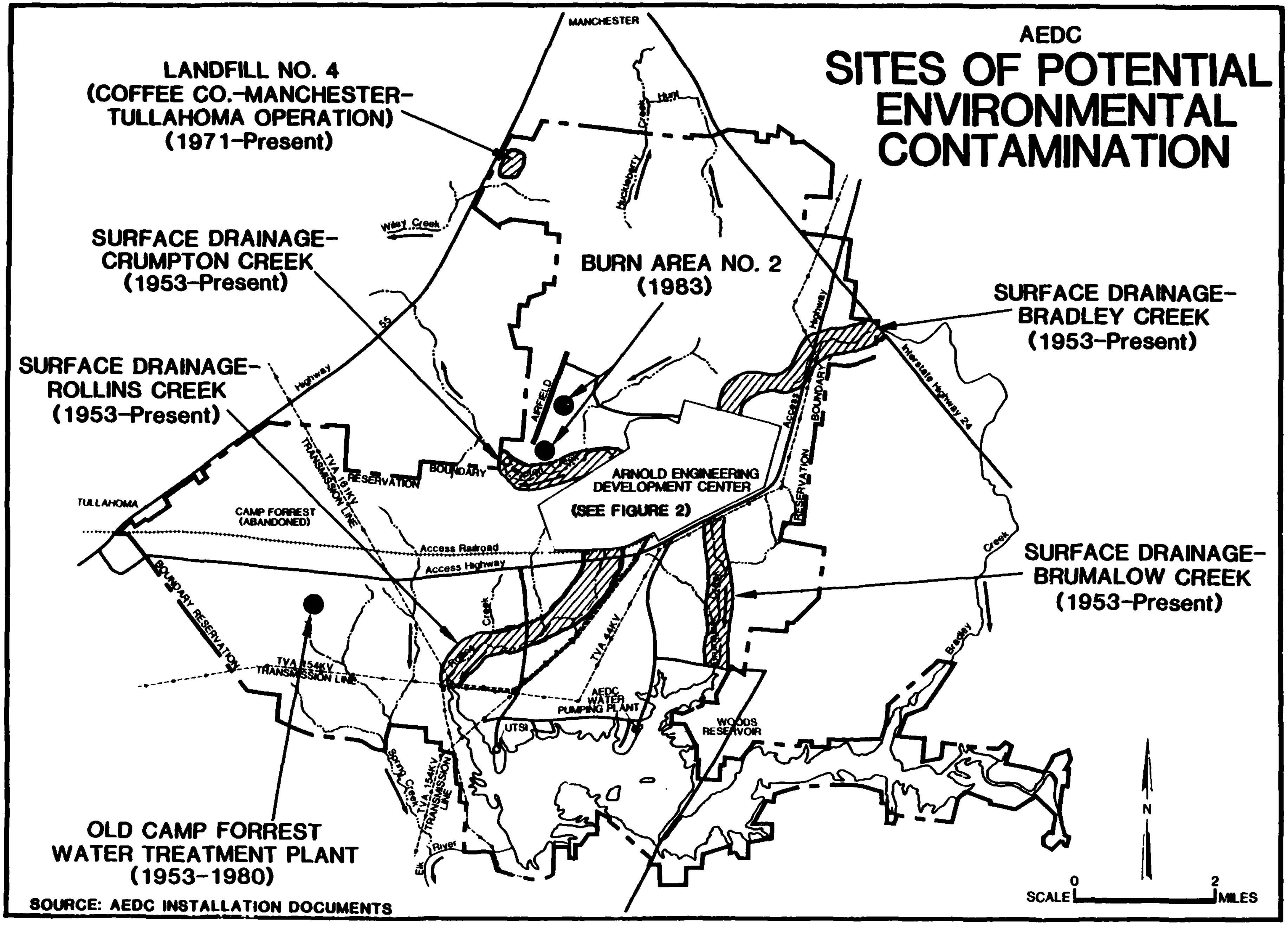
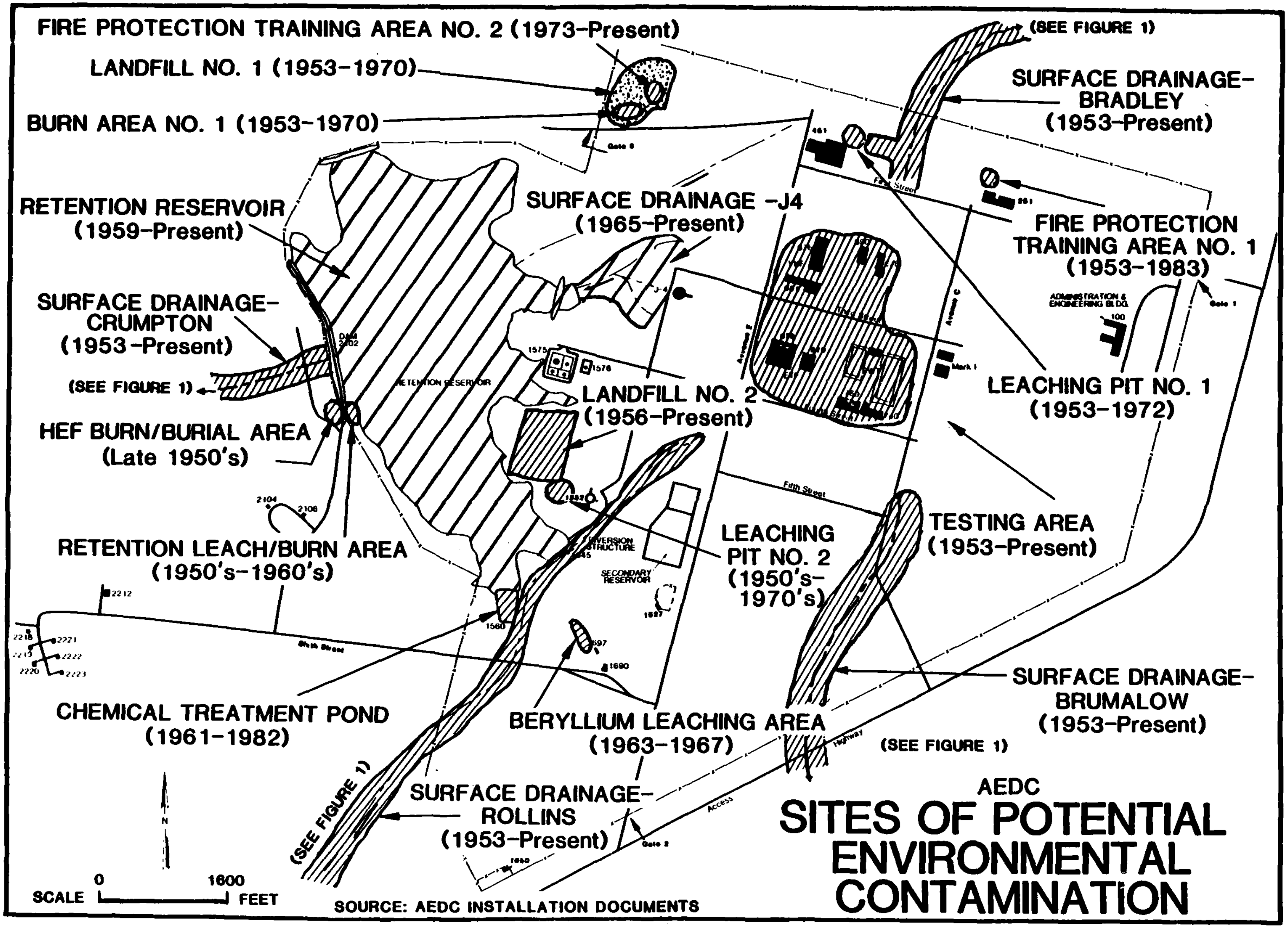

AEDC
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION
LANDFILL NO. 4 (COFFEE CO.-MANCHESTER-TULLAHOMA OPERATION) (1971-Present)
SURFACE DRAINAGE-CRUMPTON CREEK (1953-Present)
BURN AREA NO. 2 (1983)
SURFACE DRAINAGE-BRADLEY CREEK (1953-Present)
SURFACE DRAINAGE-ROLLINS CREEK (1953-Present)
SURFACE DRAINAGE-BRUMALOW CREEK (1953-Present)
OLD CAMP FORREST WATER TREATMENT PLANT (1953-1980)
MANCHESTER
TULLAHOMA
Hunt Creek
Huckleberry
Wiley Creek
Highway 55
AIRFIELD
BOUNDARY RESERVATION
ARNOLD ENGINEERING DEVELOPMENT CENTER
(SEE FIGURE 2)
CAMP FORREST (ABANDONED)
Access Railroad
Access Highway
Access Highway
TVA 161KV TRANSMISSION LINE
TVA 154KV TRANSMISSION LINE
TVA 44KV
Interstate Highway 24
Bradley Creek
Rollins Creek
Spring Creek
Elk River
AEDC WATER PUMPING PLANT
UTSI
WOODS RESERVOIR
N
SCALE 0 2 MILES
SOURCE: AEDC INSTALLATION DOCUMENTS

FIGURE 2



SOURCE: AEDC INSTALLATION DOCUMENTS

AEDC
SITES OF POTENTIAL ENVIRONMENTAL CONTAMINATION

TABLE 1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
AEDC

Site No./ Rank	Site Description	Operation Period	HARM Score (1)
1	Landfill No. 2/ Leaching Pit No. 2	1956-Present 1950's-1970's	80
2	Retention Reservoir/ J-4 Area Surface Drainage	1959-Present	79
3	Landfill No. 4	1971-Present	78
4	Surface Drainage - Bradley	1953-Present	73
5	Surface Drainage - Rollins	1953-Present	71
6	Camp Forrest Water Treatment Plant	1953-1980	70
7	Testing Areas	1953-Present	70
8	Leaching Pit No. 1	1953-1972	70
9	Surface Drainage - Brumalow	1953-Present	63
10	Fire Protection Training Area No. 2/Burn Area No. 1/ Landfill No. 1	1973-Present 1953-1970	62
11	Chemical Treatment Pond	1961-1982	62
12	Retention Leach/Burn Area	1950's-1960's	62
13	Fire Protection Training Area No. 1	1953-1983	58
14	Surface Drainage - Crumpton	1953-Present	53
15	HEF Burn/Burial Area	1959-1961	51
16	Beryllium Leaching Area	1963-1967	45
17	Burn Area No. 2	1983	43

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

The areas found to have sufficient potential to create environmental contamination are as follows:

- o Site No. 1 - Landfill No. 2/Leaching Pit No. 2
- o Site No. 2 - Retention Reservoir/J-4 Area Surface Drainage
- o Site No. 3 - Landfill No. 4
- o Site No. 4 - Surface Drainage - Bradley
- o Site No. 5 - Surface Drainage - Rollins
- o Site No. 6 - Camp Forrest Water Treatment Plant
- o Site No. 7 - Testing Areas
- o Site No. 8 - Leaching Pit No. 1
- o Site No. 9 - Surface Drainage - Brumalow
- o Site No. 10 - Fire Protection Training Area No. 2/Burn Area No.1/Landfill No. 1
- o Site No. 11 - Chemical Treatment Pond
- o Site No. 12 - Retention Leach/Burn Area

The areas judged to have *minimal* potential to create environmental contamination are as follows:

- o Site No. 13 - Fire Protection Training Area No. 1
- o Site No. 14 - Surface Drainage - Crumpton
- o Site No. 15 - HEF Burn/Burial Area
- o Site No. 16 - Beryllium Leaching Area
- o Site No. 17 - Burn Area No. 2

RECOMMENDATIONS

Recommended guidelines for future land use restrictions at the disposal sites are presented in Section 6. A program for proceeding with Phase II and other IRP activities at AEDC is also presented in Section 6. The recommended actions include a soil boring, monitoring well, sampling and analysis program to determine if contamination exists for some sites (Nos. 3 to 12) and to confirm and determine the extent of contaminant migration for others (Nos. 1 and 2). This program may be expanded to define the extent and type of contamination if the

initial step reveals contamination for Site Nos. 3 to 12. The Phase II recommendations are summarized in Table 2.

TABLE 2
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
1	Landfill No. 2/Leaching Pit No. 2 (80)	Perform a geophysical survey to define potential contamination plumes and to evaluate the effectiveness of the existing ground-water monitoring system. If survey indicates potential contamination in the Manchester aquifer, install monitoring wells into the deeper aquifer to confirm the geophysical data. For the existing monitoring wells, run total organic halogens along with other parameters currently evaluated.
2	Retention Reservoir/ J-4 Surface Drainage (79)	Obtain five samples at the surface of the bottom sediment in the reservoir, one sediment sample in the J-4 drainage channel and one background sample. Analyze the samples for the parameters in List A, Table 6.2.
3	Landfill No. 4 (78)	Perform a geophysical survey to locate major areas of drum disposal and to also define potential contamination plumes. Using the geophysical data locate and install four additional monitoring wells suitably located with one hydrogeologically upgradient of the site and the others downgradient. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List B, Table 6.2.
4	Surface Drainage - Bradley (73)	Obtain five sediment samples in Ditch H and its tributary from the Model Shop. Obtain one background sample. Space the drainage channel samples uniformly from First Street to the Access Highway. Analyze the samples for the parameters in List A, Table 6.2.

TABLE 2
(Continued)
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
5	Surface Drainage - Rollins (71)	Obtain six sediment samples in the Rollins channel and one background sample. Space five drainage channel samples uniformly from downstream of the Chemical Treatment Pond to about one mile south of the Access Highway. Obtain one sample in the channel upstream of the Retention Pond diversion structure. Analyze the samples for the parameters in List A, Table 6.2.
6	Camp Forrest Water Treatment Plant (70)	Install one upgradient and three downgradient monitoring wells. Perform a geophysical survey to enable effective location of the monitoring wells. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List C, Table 6.2.
7	Testing Areas (70)	Measure ground-water levels and obtain samples in existing piezometers at AEDC and then use that data to locate additional monitoring wells if needed around the testing area. Install one well hydrogeologically upgradient from the testing area. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List D, Table 6.2. Sample barometric sump and dewatering well discharge water from the test cells and analyze for the parameters in List D, Table 6.2.
8	Leaching Pit No. 1 (70)	Obtain one soil boring through the old leaching pit area. Determine the ground-water level and analyze the unsaturated soils for the parameters in List E, Table 6.2. Install one upgradient and two downgradient monitoring wells. Use piezometric data from Testing Area to locate the monitoring

TABLE 2
(Continued)
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
		wells. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List F, Table 6.2.
9	Surface Drainage - Brumalow (63)	Obtain three sediment samples in the drainage channel and one background sample. Obtain one sample north of the Access Highway and two samples south. Analyze the samples for the parameters in List A, Table 6.2.
10	Fire Protection Training Area No. 2/Burn Area No. 1/Landfill No. 1 (62)	Perform a geophysical survey to obtain preliminary data of the subsurface disposal site conditions. Using the geophysical survey data, locate five monitoring wells at the site with one upgradient and four downgradient. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List G, Table 6.2.
11	Chemical Treatment Pond (62)	Obtain two bottom sediment samples and one background sample. Analyze the samples for the parameters in List H, Table 6.2.
12	Retention Leach/Burn Area (62)	Obtain samples at the surface nd at four feet depth at the leach/burn site. Obtain one background sample. Analyze the samples for the parameters in List H, Table 6.2.

* If contamination is found in the uppermost aquifer from the recommended monitoring wells, deeper wells penetrating the Manchester aquifer should be installed to assess the extent of movement to the deeper zone.

PURPOSE AND SCOPE

The Installation Restoration Program is a four-phased program (Figure 1.1) designed to assure that identification, confirmation/quantification, and remedial actions are performed in a timely and cost-effective manner. Each phase is briefly described below:

- Phase I - Installation Assessment/Records Search - Phase I is to identify and prioritize those past disposal sites that may pose a hazard to public health or the environment as a result of contaminant migration to surface or ground waters, or have an adverse effect by its persistence in the environment. In this phase, it is determined whether a site requires further action to confirm an environmental hazard or whether it may be considered to present no hazard at this time. If a site requires immediate remedial action, such as removal of abandoned drums, the action can proceed directly to Phase IV. Phase I is a basic background document for the Phase II study.
- Phase II - Confirmation/Quantification - Phase II is to define and quantify, by preliminary and comprehensive environmental and/or ecological survey, the presence or absence of contamination, the extent of contamination, waste characterization (when required by the regulatory agency), and to identify sites or locations where remedial action is required in Phase IV. Research requirements identified during this phase will be included in the Phase III effort of the program.
- Phase III - Technology Base Development - Phase III is to develop a sound data base upon which to prepare a comprehensive remedial action plan. This phase includes implementation of research requirements and technology for objective assessment of adverse effects. A Phase III requirement can be identified at any time during the program.
- Phase IV - Operations/Remedial Actions - Phase IV includes the preparation and implementation of the remedial action plan.

Engineering-Science (ES) was retained by the United States Air Force to conduct the Phase I Records Search at Arnold Engineering

SECTION 1

INTRODUCTION

BACKGROUND AND AUTHORITY

The United States Air Force, due to its primary mission of defense of the United States, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, state, and local governments have developed strict regulations to require that disposers identify the locations and contents of past disposal sites and take action to eliminate hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and under Section 3012, state agencies are required to inventory past disposal sites, and Federal agencies are required to make the information available to the requesting agencies. To assure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and fully evaluate suspected problems associated with past hazardous contamination, and to control hazards to health and welfare that resulted from these past operations. The IRP is the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, clarified by Executive Order 12316. CERCLA is the primary legislation governing remedial action at past hazardous waste disposal sites.

Development Center (AEDC) under Contract No. F08637 83 G0005 5000. This report contains a summary and an evaluation of the information collected during Phase I of the IRP and recommended follow-on actions. The approximate land area included as part of the AEDC study are as follows:

Main AEDC Industrial/Testing Area	3,000 acres
Woods Reservoir	4,000 acres
Hardwood Forest	30,000 acres
Tennessee National Guard Training Area	2,600 acres
University of Tennessee Space Institute	365 acres

The activities performed as a part of the Phase I study scope included the following:

- Review of site records
- Interviews with personnel familiar with past generation and disposal activities
- Survey of types and quantities of wastes generated
- Determination of current and past hazardous waste treatment, storage, and disposal activities
- Description of the environmental setting at the Center
- Review of past disposal practices and methods
- Field observation of AEDC facilities
- Collection of pertinent information from federal, state and local agencies
- Assessment of the potential for contaminant migration
- Development of recommendations for follow-on actions

ES performed the on-site portion of the records search during June 1984. The following team of professionals were involved:

- R. L. Thoem, Environmental Engineer and Project Manager, MS Sanitary Engineering, 20 years of professional experience
- H. D. Harman, PG, Hydrogeologist, BS Geology, 9 years professional experience

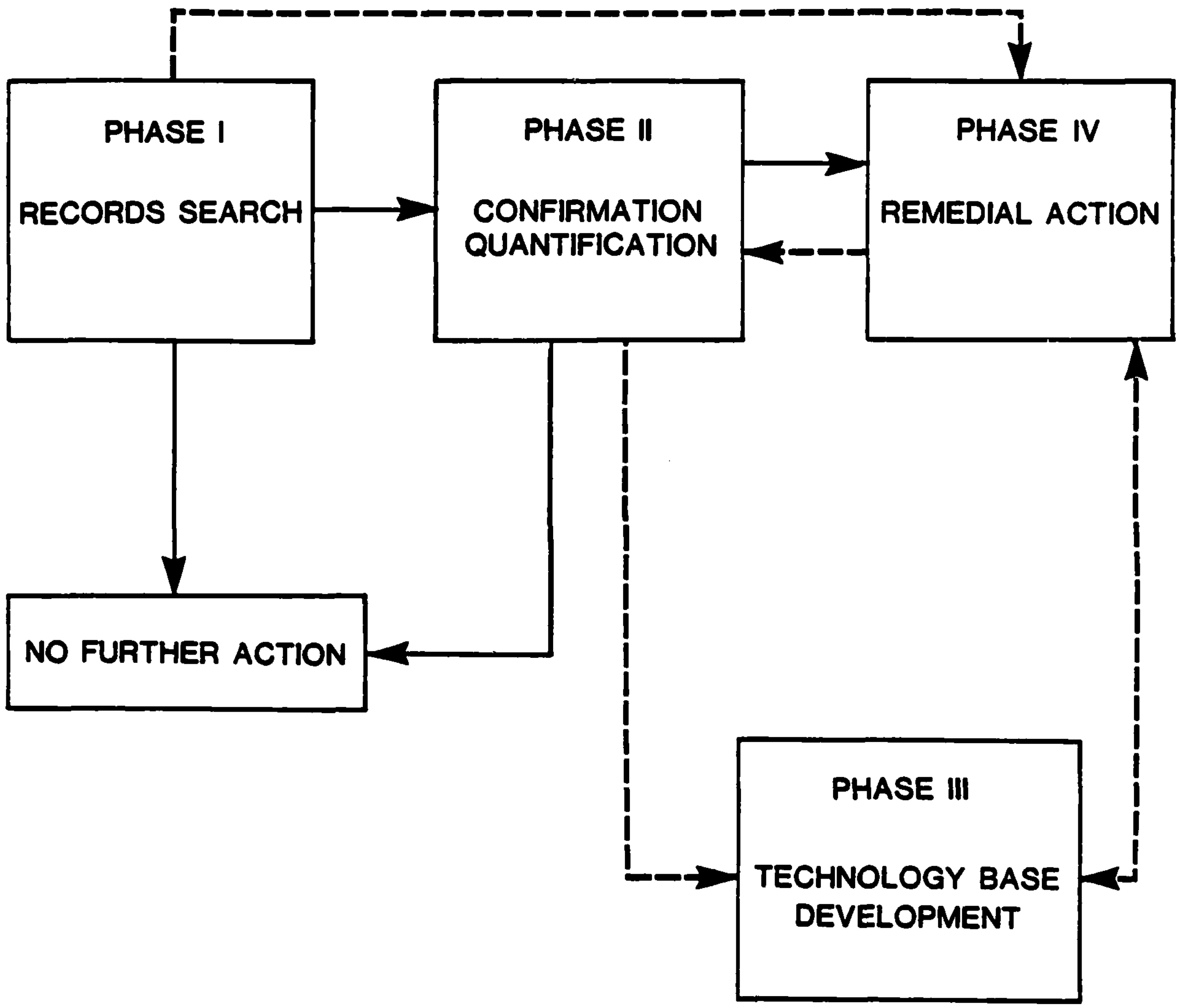


FIGURE 1.1 INSTALLATION RESTORATION PROGRAM

SOURCE: AFESC

- T. R. Harper, Environmental Scientist, BS Chemistry and Microbiology, 1 year professional experience

More detailed information on these three individuals is presented in Appendix A.

METHODOLOGY

The methodology utilized in the Arnold Engineering Development Center Records Search began with a review of past and present industrial operations conducted at the station. Information was obtained from available records such as shop files and real property files, as well as interviews with 32 past and present AEDC employees from various operating areas. Those interviewed included current and past personnel associated with civil engineering, safety and environmental, fuels management, roads and grounds maintenance, laboratory, fire protection, real property, history and various other contractor representatives. A listing of interviewee positions with approximate years of service is presented in Appendix B.

Concurrent with the employee interviews, the applicable federal, state and local agencies were reviewed for pertinent study area related environmental data. The agencies contacted are listed below and in Appendix B.

- Tennessee Department of Conservation, Division of Geology
- Tennessee Department of Public Health, Division of Solid Waste Management
- Tennessee Department of Public Health, Division of Water Quality Control
- Tennessee Valley Authority
- Tennessee Wildlife Resources Agency
- U.S. Environmental Protection Agency, Region IV
- U.S. Department of Agriculture, Soil Conservation Service
- U.S. Department of Commerce, National Oceanic and Atmospheric Administration
- U.S. Department of Defense, Corps of Engineers

- U.S. Department of Housing and Urban Development, Federal Emergency Management Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey, Water Resources Division
- University of Tennessee Space Institute (UTSI) (AEDC Site)
- Coffee Co. - Manchester - Tullahoma Landfill (AEDC Site)

The next step in the activity review was to identify all sources of hazardous waste generation and to determine the past management practices regarding the use, storage, treatment, and disposal of hazardous materials from the various sources at the Center. Included in this part of the activities review was the identification of all known past disposal sites and other possible sources of contamination such as spill areas.

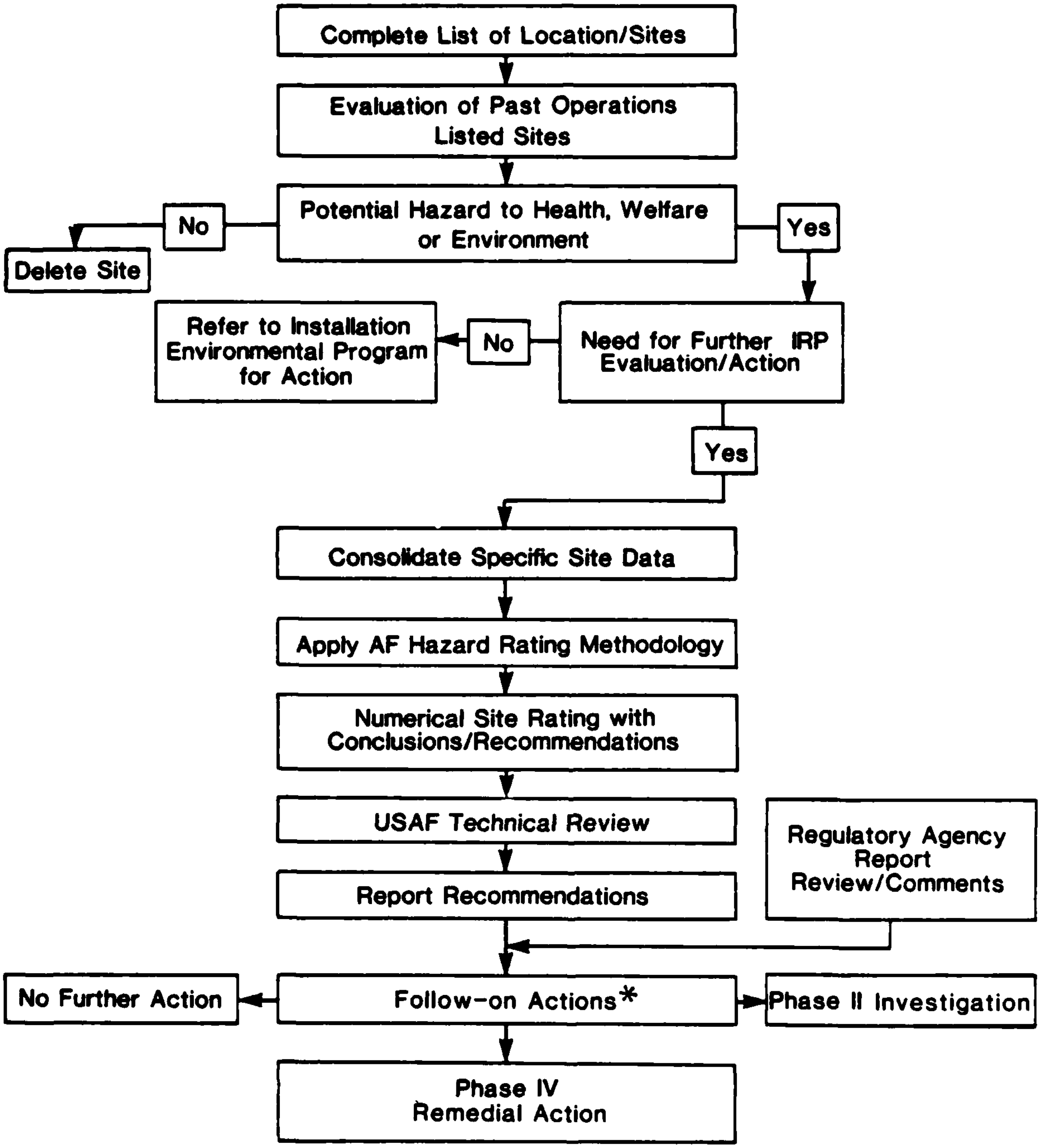
An overflight of AEDC was not feasible; therefore, a general ground tour of the identified sites was made by the ES Project Team to gather site-specific information including: (1) general observations of existing site conditions; (2) visual evidence of environmental stress; (3) presence of nearby drainage ditches or surface waters; and (4) visual inspection of these water bodies for any obvious signs of contamination or leachate migration.

A decision was then made, based on all of the above information, whether a potential hazard to health, welfare or the environment exists at any of the identified sites using the Flow Chart shown in Figure 1.2. If no potential existed, the site was deleted from further consideration. For those sites where a potential hazard was identified, a determination of the need for IRP evaluation/action was made by considering site-specific conditions. If no further IRP evaluation was determined necessary, then the site was referred to the installation environmental program for appropriate action. If a site warranted further investigation, it was evaluated and rated using the Hazard Assessment Rating Methodology (HARM). The HARM score indicates the relative potential for adverse effects on health or the environment at each site evaluated.

FIGURE 1.2

PHASE I INSTALLATION RESTORATION PROGRAM

RECORDS SEARCH FLOW CHART



*Beyond Scope of Phase I

Source: AFESC

SECTION 2

INSTALLATION DESCRIPTION

LOCATION, SIZE, AND BOUNDARIES

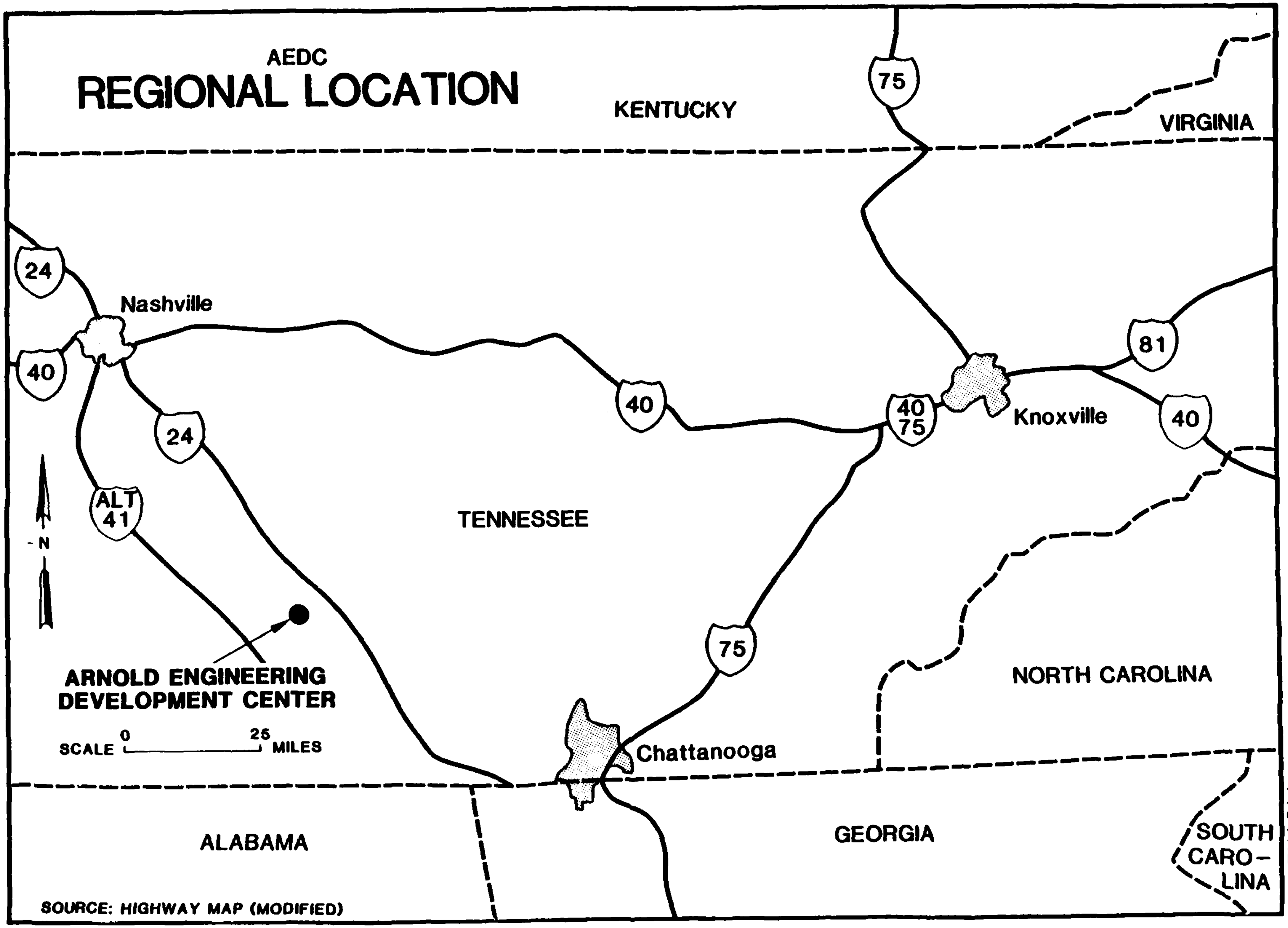
Arnold Engineering Development Center (AEDC) is located in southern-middle Tennessee (Coffee and Franklin Counties), midway between Chattanooga and Nashville (Figures 2.1 and 2.2). The Center spans east from Tullahoma to Interstate 24, with the Elk River forming the southern boundary, and north to near the southern edge of Manchester.

The AEDC site (Figure 2.3) is primarily composed of land formerly occupied by the Camp Forrest U.S. Army Training Center (approximately 32,000 acres) which was conveyed to the Federal Government by the State of Tennessee in the Public Acts of 1951. In 1950 and 1951, approximately 7,000 acres of additional land was acquired through purchase and condemnation. This land purchase, which included the Elk River, enabled AEDC to create the 4,000 acre Woods Reservoir which provides cooling water for AEDC's test facilities. The site also includes the 3,000 acre fenced area for test and support facilities (Figure 2.4), and a 6,000 foot airstrip. In addition, Air Force easements comprise slightly less than one acre. The majority of the site land (30,000 acres) is heavily forested and covered under a management plan. The Tennessee Wildlife Resources Agency has a license with the Air Force to implement, operate and manage a wildlife program which is in accordance with an approved Game Management Plan. The program allows them to enter, develop, and use certain vacant areas at the site.

HISTORY

Construction of the Air Engineering Development Center (renamed Arnold Engineering Development Center in June 1951) began in June 1950. The site in middle Tennessee was chosen because of the availability of land, water, and power needed for the work AEDC performs. Land was

FIGURE 2.1



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required to reduce noise levels created during tests, water for cooling purposes, and electricity to power the huge motor drive systems.

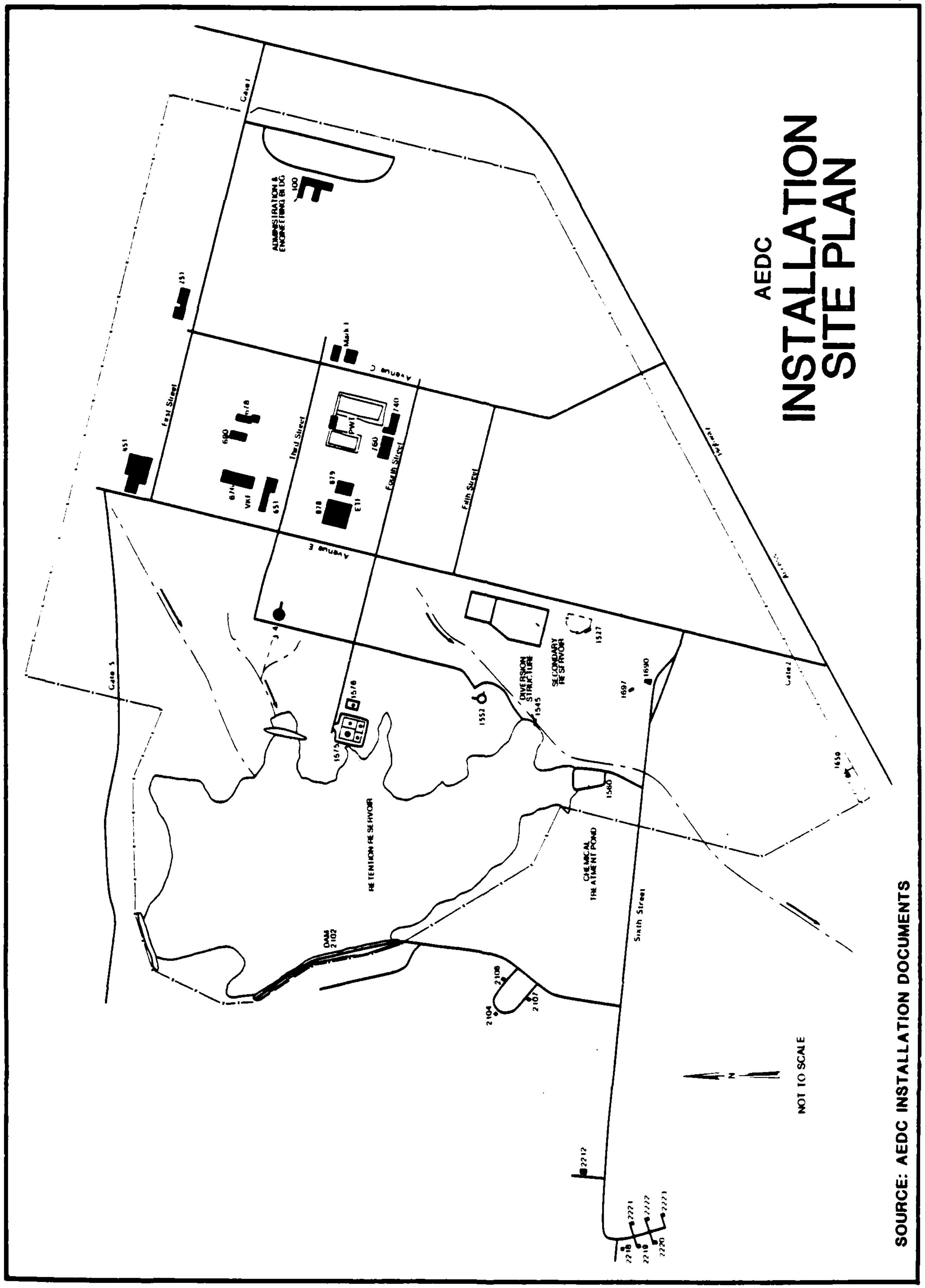
AEDC contains 41 major test units which are grouped into three facilities: the Engine Test Facility (ETF), the von Karman Gas Dynamics Facility (VKF), and the Propulsion Wind Tunnel (PWT). ETF, which contains 14 major test cells, was the first test facility to begin operations in 1953. ETF is used to develop and evaluate propulsion systems for advanced aircraft, missles, satellites, and space vehicles. The PWT facility began operations in January 1955, and is designed for testing large scale models or full scale vehicles together with their propulsion systems. In 1968, the PWT facility placed into operation a transonic tunnel for aircraft weapons compatability. The VKF facility which was opened in 1954 is composed of eight different wind tunnels and is devoted to supersonic and hypersonic aerodynamic and heating studies, satellite component testing and ballistic and impact tests. AEDC plans on opening the Aeropropulsion Systems Test Facility (ASTF) in late 1985, which is designed primarily for testing larger and higher performance air breathing engine propulsion systems.

ORGANIZATION AND MISSION

Arnold Engineering Development Center is a test organization of the Air Force Systems Command. The Center currently employs approximately 3,500 operating contractor employees, 180 Air Force officers and airmen, and 230 civil service personnel.

The primary mission of the Center is to simulate actual flight conditions in aerodynamic, propulsion and space environmental ground test facilities and to detect and solve problems associated with aerospace systems. In addition, the Center conducts research and applies new technology to improve environmental facilities, and associated testing techniques and instrumentation.

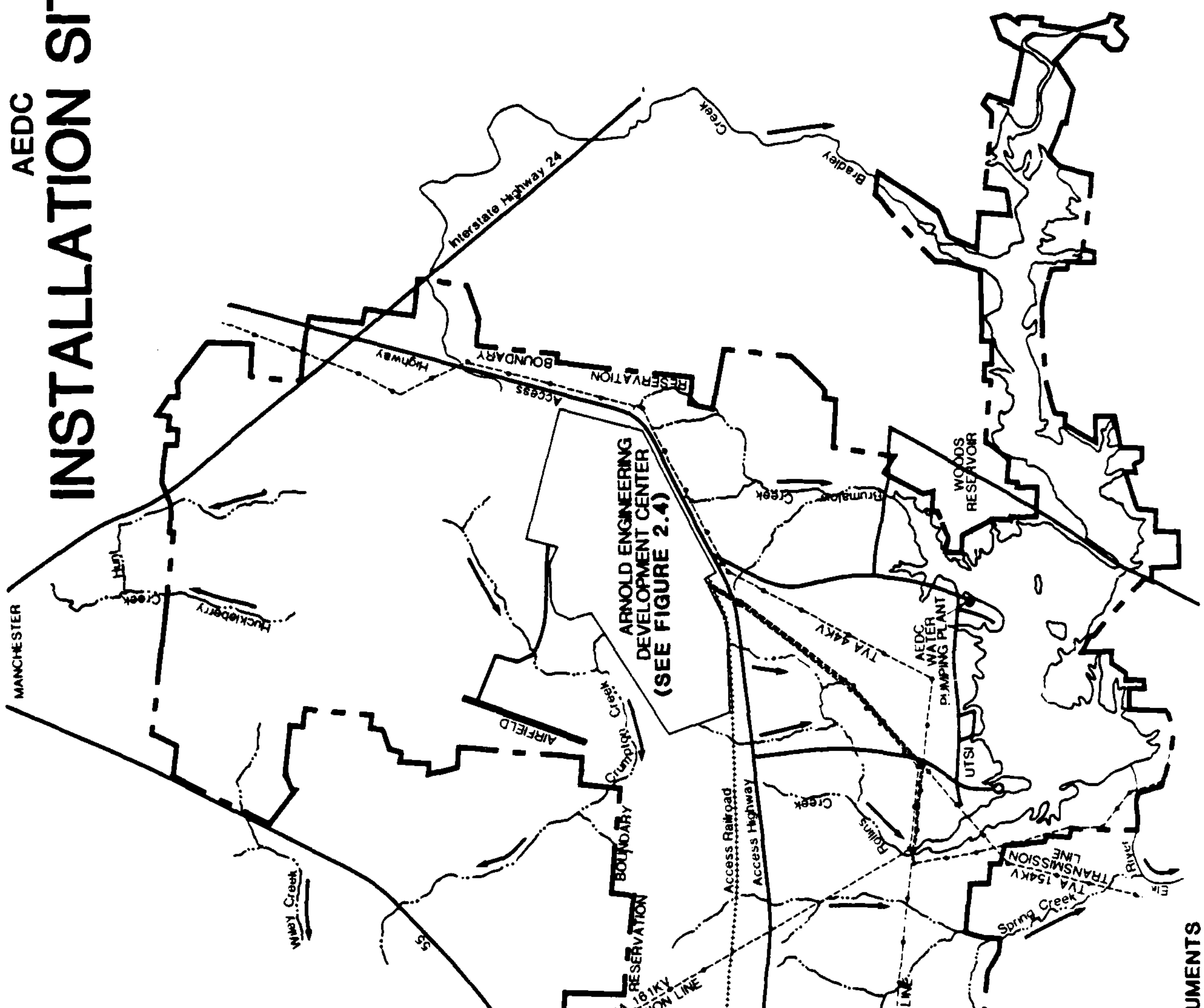
The Center is under the direction of AEDC Headquarters which consists of the Office of the Commander, Deputy for Comptroller, Deputy for Facilities, Deputy for Operations, Deputy for Contracting and Logistics and the 4960th Air Base Squadron. The 4960th Air Base Squadron serves as host unit of Arnold Air Force Station and is responsible for managing the installation and providing services to the primary mission elements



AEDC
INSTALLATION SITE PLAN

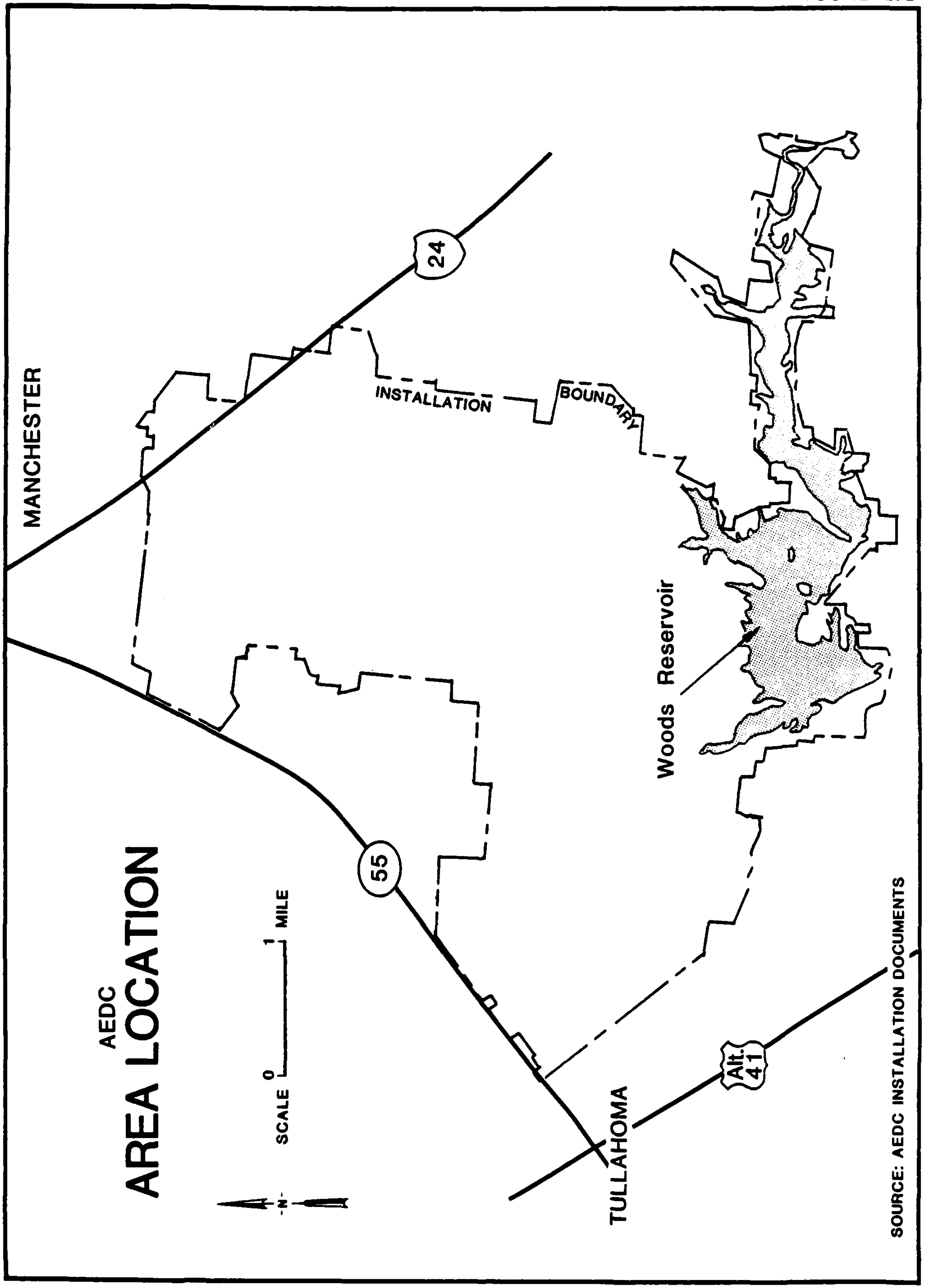
SOURCE: AEDC INSTALLATION DOCUMENTS

AEDC INSTALLATION SITE PLAN



SOURCE: AEDC INSTALLATION DOCUMENTS

FIGURE 2.2



ES ENGINEERING-SCIENCE

of the station. Their responsibility also includes station morale, welfare and recreation activities that include housing and commissary support. The Squadron administers personnel actions, medical, security, and administrative services, and manages the operation and activities associated with the Arnold Airfield.

Three contractors are presently operating at the Center under the supervision of the Air Force. The contractors and their areas of responsibility are as follows:

1. Pan Am World Services - Pan Am provides technical support and base support activities in areas such as supply, fire protection, transportation and security police.
2. Sverdrup Technology, Inc. - Sverdrup operates aeropropulsion testing units that comprise the Engine Test Facility and will operate the new Aeropropulsion Systems Test Facility.
3. Arvin Calspan Field Services, Inc. - Calspan operates the Propulsion Wind Tunnel and the von Karman Facility wind tunnels used in aerodynamic testing.

The additional tenants occupying AEDC include the following organizations. The mission of some of these tenants is presented in Appendix C.

Communications Detachment, 1973-1 (AFCS)
University of Tennessee Space Institute
AAFES
AEDC Area Engineer, Mobile District C/E
AFCOMS OL-HB/FCS
Defense Contract Administration Office (DCASR-Atlanta)
Defense Contract Audit Agency
Air Force Office of Special Investigations DET 816 (AFOSI)
Volunteer Girl Scouts
Boy Scouts, Elk River District
U.S. Department of Agriculture
Tennessee State Game & Fish Commission
Coffee County and the cities of Manchester and Tullahoma
Tullahoma Kiwanis Club

SECTION 3

ENVIRONMENTAL SETTING

The environmental setting of the AEDC is described in this section with an emphasis on the identification of natural features that may promote the movement of hazardous waste contaminants. Environmental conditions pertinent to this study are summarized at the conclusion of this section.

METEOROLOGY

The climate of the AEDC area is temperate and rainy with mild winters and hot summers. The average temperatures of winter and summer vary only 34 degrees. The greatest rainfall occurs in winter and spring (SCS, 1959). Selected meteorological data for AEDC are summarized in Table 3.1.

Two climatic features of interest in determining the potential for movement of contaminants are net precipitation and rainfall intensity. Net precipitation is an indicator of the potential for leachate generation and is equal to the difference between precipitation and evaporation. Rainfall intensity is an indicator of the potential for excessive runoff and erosion. The one-year, 24-hour rainfall event is used to gauge the potential for runoff and erosion.

The six and one-half years of precipitation data presented in Table 3.1 indicates that the yearly average precipitation at AEDC is 54.17 inches. Although these data have a limited period of record, they indicate identical results as compared with data from the Tullahoma weather observation station which recorded data from 1887 to 1955 (68 years). The yearly average precipitation at the Tullahoma station (9 miles west of the AEDC plant area) is also 54.17 inches (SCS, 1959). The mean annual lake evaporation for the AEDC area is 37 inches (NOAA, 1979). The net precipitation for the AEDC area is therefore plus (+) 17.17 inches. The positive value of net precipitation indicates that

TABLE 3.1

CLIMATIC CONDITIONS FOR AEDC

	JAN	FEB	MAR	APR	MAY	JUN
TEMPERATURE (°F)						
Average Monthly	41.1	43.4	49.9	59.1	66.6	74.8
PRECIPITATION (IN)						
Average Monthly	5.46	5.56	6.05	4.65	4.03	3.96

	JUL	AUG	SEP	OCT	NOV	DEC
TEMPERATURE (°F)						
Average Monthly	77.5	76.4	71.8	60.3	49.0	42.2
PRECIPITATION (IN)						
Average Monthly	4.88	3.80	2.99	2.96	4.38	5.45

Period of Record: January 1963 through July 1970

Source: AEDC Installation Documents

there is a moderate potential for precipitation to infiltrate the surface soils on the installation. The one-year, 24-hour rainfall event in the AEDC area is estimated to be 3.1 inches (NOAA, 1963). This value indicates that there is a moderate potential for runoff and erosion.

GEOGRAPHY

AEDC is located within the Highland Rim Plateau Physiographic Province of south-central Tennessee (Figure 3.1). This province is characterized by gently rolling to nearly level topography typical of a plateau (Theis, 1936). The plateau is approximately 1,000 feet above the National Geodetic Vertical Datum of 1929 (NGVD) and circles the Nashville Basin Physiographic Province.

Topography

The topography of AEDC is typical of the general province topography. The installation covers land with gently rolling to nearly level topography with land surface elevations ranging from approximately 1,100 feet above NGVD in the northern portion to 960 feet above NGVD in the southern portion along the Woods Reservoir shoreline. The land surface elevation in the AEDC plant area varies from approximately 1,100 feet above NGVD near the Administration and Engineering Building (No. 100) to 1,080 feet above NGVD along the Retention Reservoir shoreline.

A significant topographic feature of the AEDC area, referred to as "The Barrens," occupies a large area both north and south of the plant area. "The Barrens" are relatively flat and are poorly drained. Natural swamp forest and marshes exist within "The Barrens." Further discussion of "The Barrens" is found in the Surface-Water Resources portion of this section.

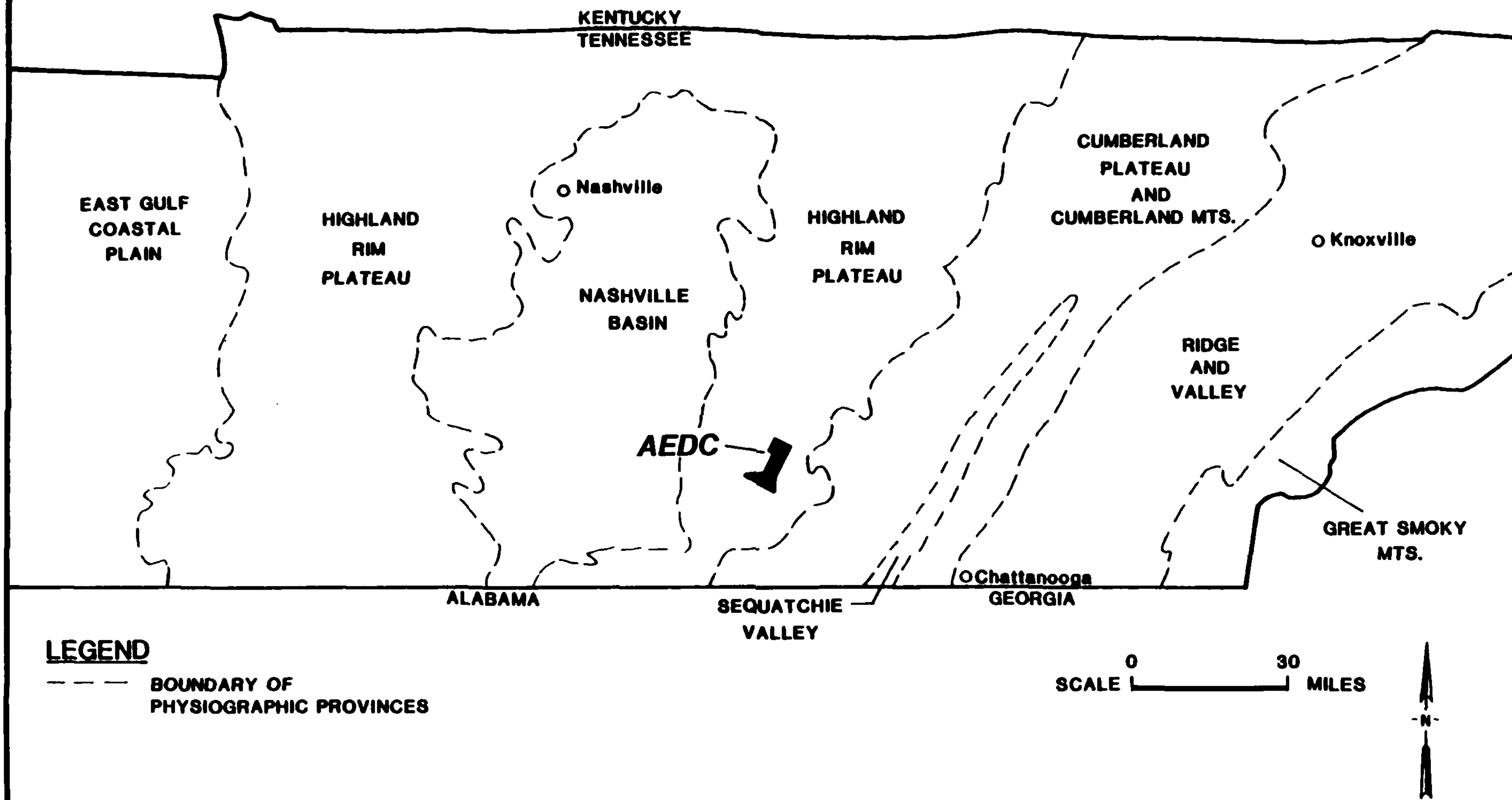
The areas immediately surrounding AEDC include the municipalities of Tullahoma to the west and Manchester to the north. Woods Reservoir, a man-made lake along the Elk River, occupies most of the southern installation boundary. Areas northwest, northeast, east and southeast of AEDC are rural areas of farms and ranches.

Soils

The soils of AEDC are typically loam and combinations of cherty, silty and clayey loam. Loam is a soil with varying proportions of sand, clay and organic matter. The soils have developed on land underlain by

FIGURE 3.1

AEDC
MAJOR PHYSIOGRAPHIC PROVINCES



SOURCE: THEIS, 1936

limestone and cherty limestone bedrock of the area. Some soils have developed along stream drainage patterns; these soils contain a greater proportion of alluvial matter including sand and gravel. Figures 3.2 and 3.3 illustrate the distribution of the AEDC soils. Figure 3.2 shows the general soil types over the entire AEDC area whereas Figure 3.3 shows the detailed distribution of soil types in the AEDC plant area. Table 3.2 summarizes the soil descriptions, slopes and natural drainage characteristics.

The two most widely distributed soil types, Dickson-Baxter-Greendale and Dickson-Mountview-Lobelville, have gently sloping land surfaces and are moderately well drained to somewhat poorly drained (SCS, 1958 and 1959). Soil types near the Woods Reservoir are moderately to well drained.

The soil types within the AEDC plant area are for the most part well drained soils. Dickson silt loam and Dickson silt loam (eroded) underly a majority of the plant area. Some soil types which occupy old and present drainage patterns are somewhat poorly to poorly drained. These soil types are Lawrence silt loam, Lee silt and Lobelville silt loam (local alluvial phase).

The soil property of concern in assessing the potential for surface-water infiltration is vertical permeability. Although no data is available concerning permeability values, the surficial soils within the plant area are generally described as well drained and possess moderate permeability. The content of clay in some areas reduces the permeability. The Soil Conservation Service classification as well drained and the presence of clay in the soil indicates that surface water will infiltrate with a moderate rate.

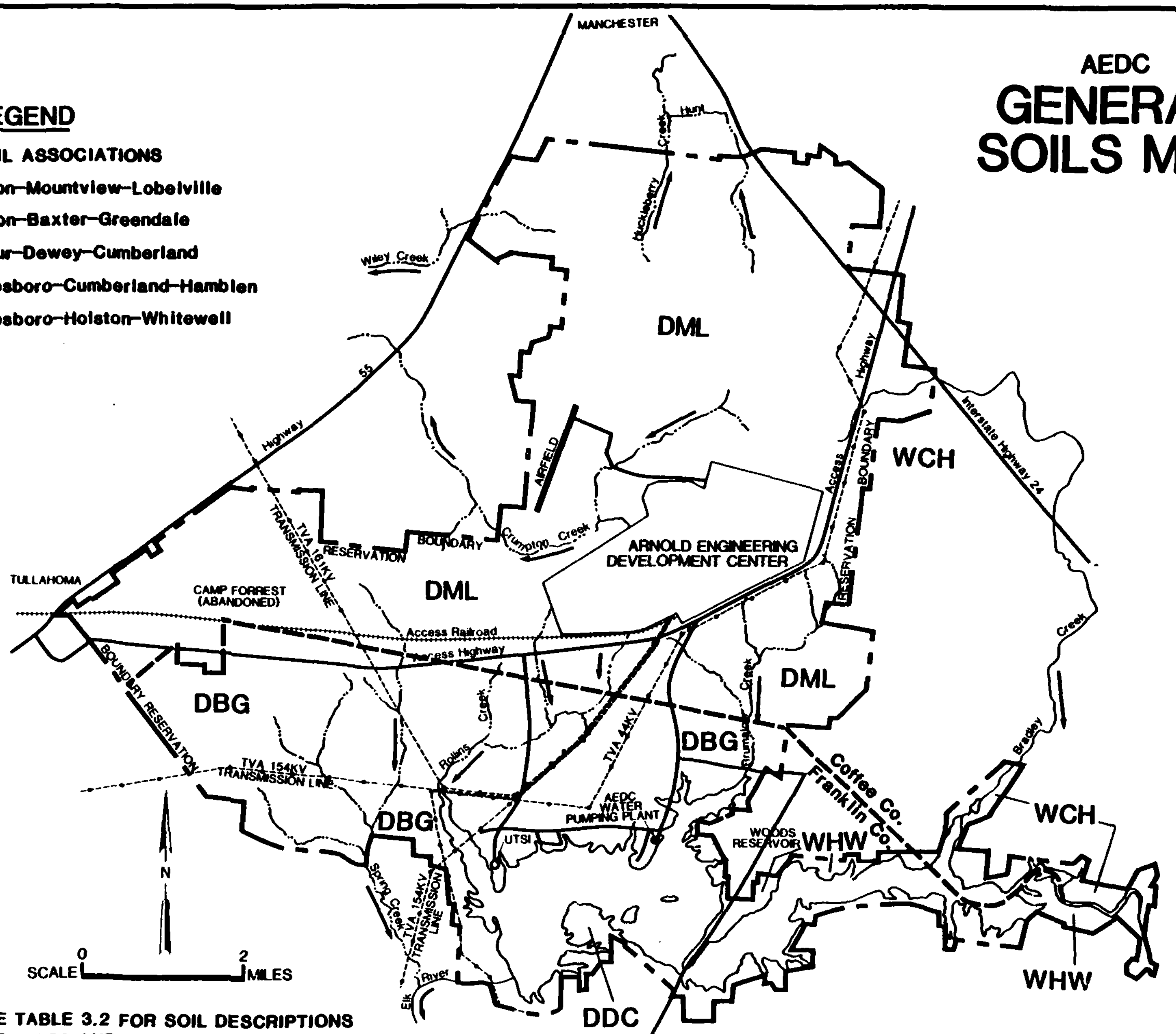
SURFACE-WATER RESOURCES

AEDC is located within both the Duck River Drainage Basin and the Elk River Drainage Basin. The drainage divide is located southwest to northeast through the center of AEDC (Figure 3.4).

Drainage

Drainage within AEDC is controlled by natural streams and man-made ditches. Figure 3.4 illustrates the numerous streams within the area. Within the Duck River Basin to the north and northwest, six streams

AEDC GENERAL SOILS MAP



LEGEND

SOIL ASSOCIATIONS

- DML Dickson–Mountview–Lobelville
- DBG Dickson–Baxter–Greendale
- DDC Decatur–Dewey–Cumberland
- WCH Waynesboro–Cumberland–Hamblen
- WHW Waynesboro–Holston–Whitewell

NOTE: SEE TABLE 3.2 FOR SOIL DESCRIPTIONS
SOURCE: SCS, 1958 AND SCS, 1959

FIGURE 3.3

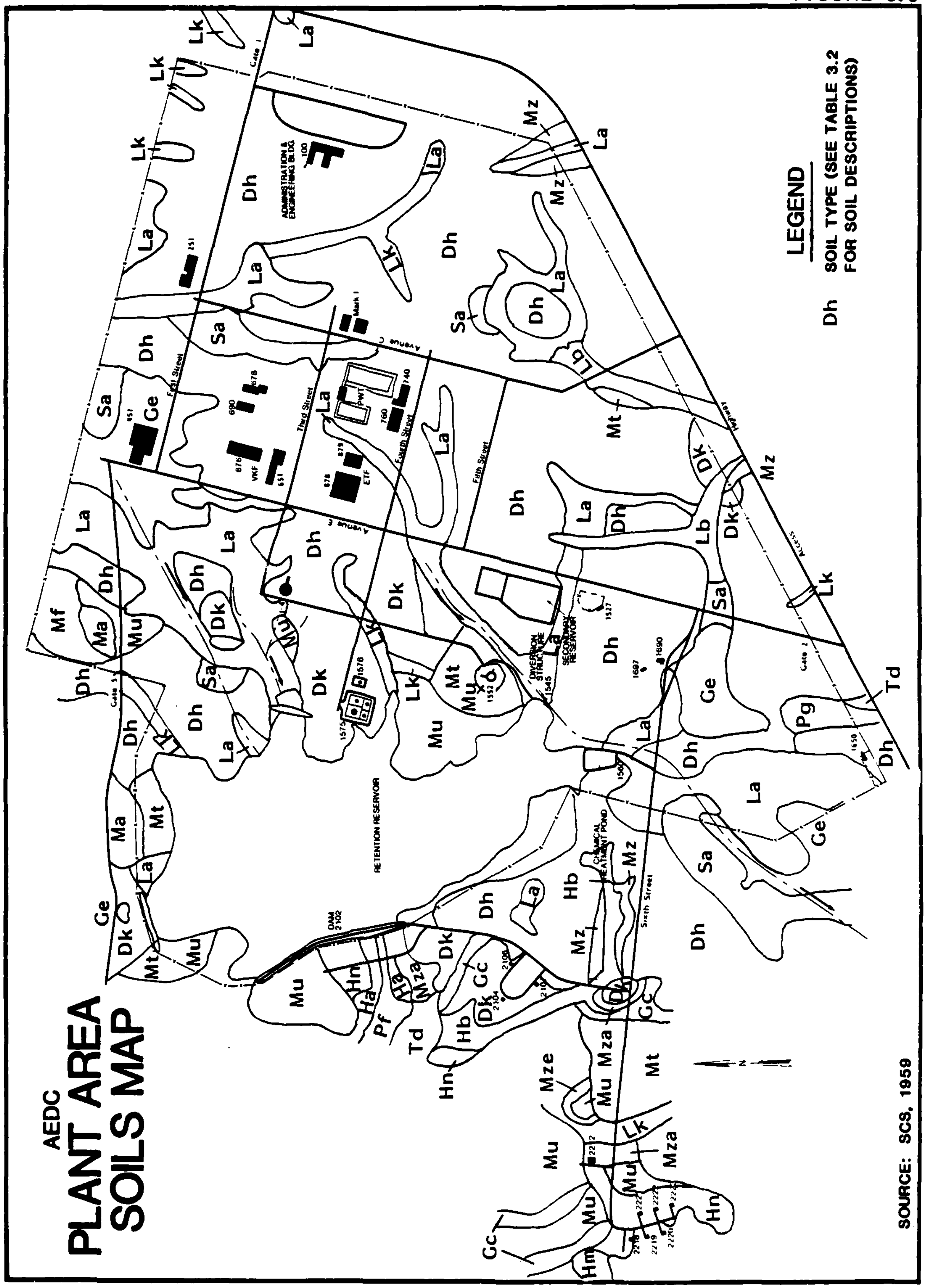

AEDC
PLANT AREA
SOILS MAP
LEGEND
Dh SOIL TYPE (SEE TABLE 3.2 FOR SOIL DESCRIPTIONS)
SOURCE: SCS, 1959
ADMINISTRATION & ENGINEERING BLDG.
RETENTION RESERVOIR
DIVERSION STRUCTURE
SECONDARY RESERVOIR
CHEMICAL TREATMENT POND
DAM 2102
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Gate 1
Gate 2
Gate 5

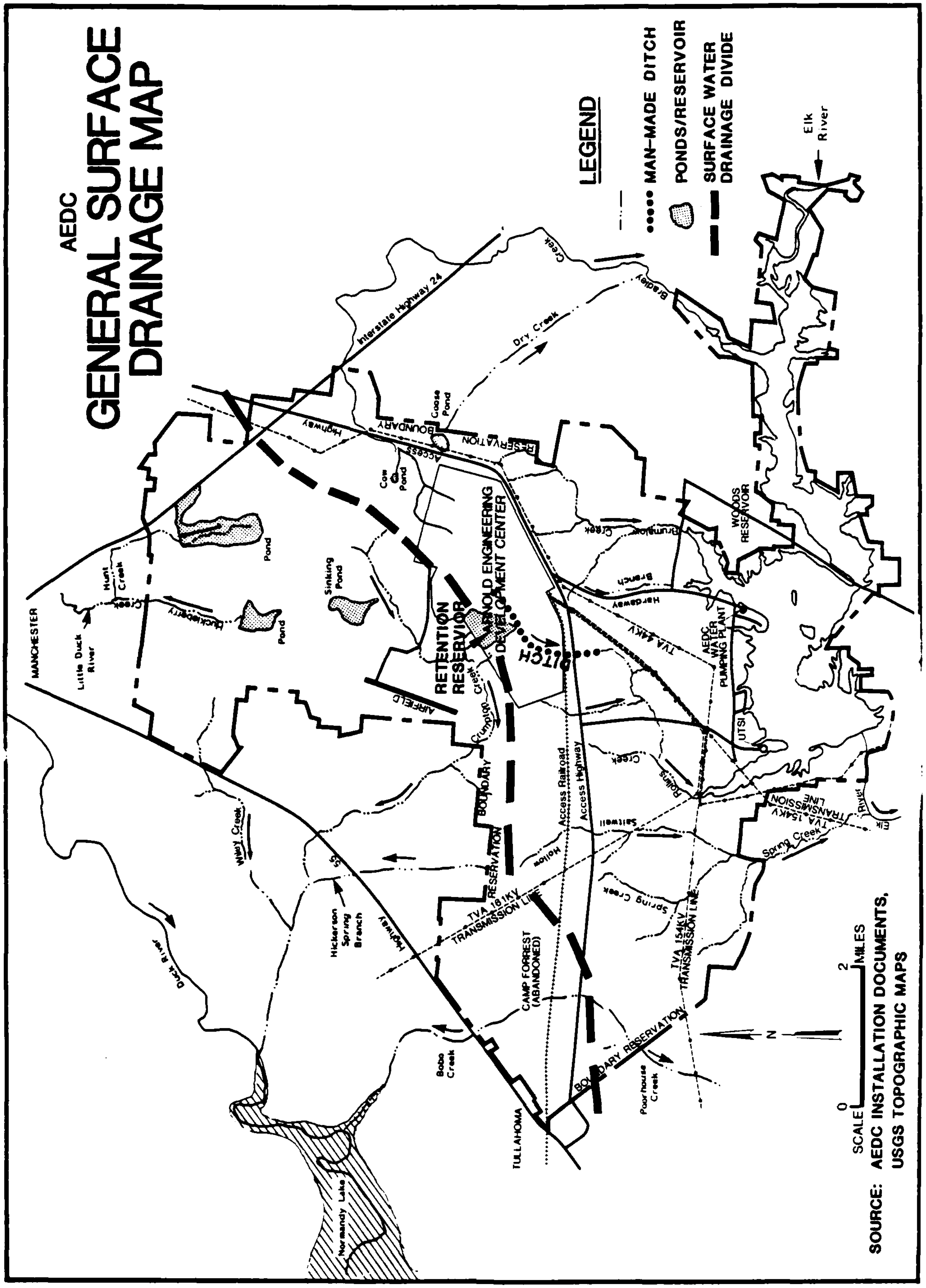
TABLE 3.2
AEDC SOILS

Symbol on Figure 3.2 &/or 3.3	Unit Description	Slope	Natural Drainage Characteristics
DBG	Dickson - Baxter - Greendale (cherty to non-cherty and soils)	Gently sloping	Moderately well drained and somewhat poorly drained
DDC	Decatur - Dewey - Cumberland (silty clay soils)	Undulating to hilly	Well drained
DML	Dickson - Mountview - Lobelville (silty loam to alluvial soils)	Gently sloping	Moderately well drained and somewhat poorly drained
WCH	Waynesboro - Cumberland - Hamblen (alluvial soils)	Gently sloping	Moderately well drained
WHW	Waynesboro - Holston - Whitewell (loam to clay-loam soils)	Nearly level to hilly	Moderately well drained
Dh	Dickson silt loam	Gently sloping	Moderately well drained
Dk	Dickson silt loam (eroded)	Gently sloping	Moderately well drained
Gc	Greendale silt loam	Gently sloping drained	Moderately well to well
Ge	Guthrie silt loam	Nearly level	Poorly drained
Ha	Hamblen fine sandy loam	Nearly level	Somewhat poor to moderately well drained
Hb	Hamblen fine sandy loam, local alluvium phase	Nearly level	Somewhat poor to moderately well drained
Hm	Holston loam	Gently sloping	Well drained
Hn	Holston loam (eroded)	Gently sloping	Well drained

TABLE 3.2
(Continued)
AEDC SOILS

Symbol on Figure 3.2 &/or 3.3	Unit Description	Slope	Natural Drainage Characteristics
La	Lawrence silt loam	Nearly level	Somewhat poorly drained
Lb	Lee silt loam	Nearly level	Poorly drained
LK	Lobelville silt loam, local alluvium phase	Nearly level	Somewhat poorly to moderat- well drained
Mf	Mimosa silty clay. severely eroded sloping phase	Severely sloping	Well drained
Mt	Mountview silt loam, gently sloping phase	Gently sloping	Well drained
Mu	Mountview silt loam, eroded gently sloping phase	Gently sloping	Well drained
Mz	Mountview silt loam, sloping shallow phase	Moderately sloping	Well drained
Mza	Mountview silt loam, eroded sloping shallow phase	Severely sloping	Well drained
Mze	Mountview silty clay loam, severely eroded sloping shallow phase	Severely sloping	Well drained
Pg	Purdy loam	Nearly level	Poorly drained
Sa	Sango silt loam	Nearly level	Moderately well drained
Td	Tyler loam	Nearly level	Somewhat poorly drained

Source: USDA, SCS, 1958 and 1959.

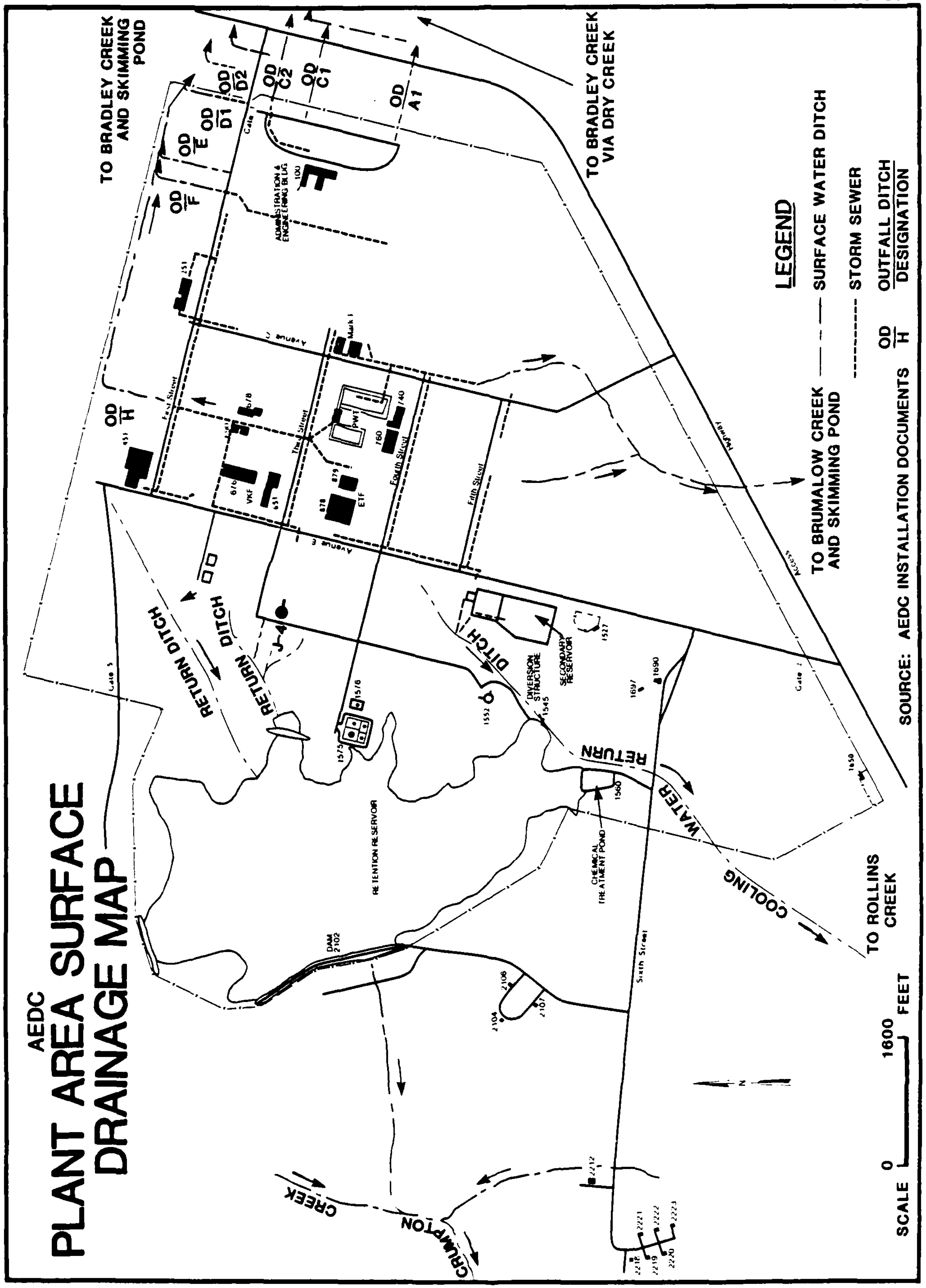

AEDC
GENERAL SURFACE DRAINAGE MAP
LEGEND
MAN-MADE DITCH
PONDS/RESERVOIR
SURFACE WATER DRAINAGE DIVIDE
Elk River
WOODS RESERVOIR
ARNOLD ENGINEERING DEVELOPMENT CENTER
RETENTION RESERVOIR
DITCH
AIRFIELD
AEDC WATER PUMPING PLANT
UTSI
TVA 44KV
TVA 154KV TRANSMISSION LINE
TVA 161KV TRANSMISSION LINE
Interstate Highway 24
Dry Creek
Bradley Creek
Goose Pond
Cow Pond
Sinking Pond
Pond
Brumalow Creek
Hardaway Branch
Rollins Creek
Saltwell Hollow
Spring Creek
Crumpton Creek
Bucklebarry Creek
Hunt Creek
Little Duck River
MANCHESTER
Wiley Creek
Hickerson Spring Branch
Duck River
Bobo Creek
Poorhouse Creek
Normandy Lake
TULLAHOMA
CAMP FORREST (ABANDONED)
Access Railroad
Access Highway
RESERVATION BOUNDARY
Highway 55
N
SCALE 0 2 MILES
SOURCE: AEDC INSTALLATION DOCUMENTS, USGS TOPOGRAPHIC MAPS

drain AEDC. Hunt and Huckleberry Creeks drain northward toward the Little Duck River which empties into the Duck River approximately seven miles downstream of the AEDC boundary. In the western portion of AEDC Wiley Creek, Crumpton Creek, Hickerson Spring Branch and Bobo Creek drain toward the Duck River. North of the AEDC plant area Crumpton Creek drains a large area of "The Barrens." Included in "The Barrens" is Sinking Pond, a Federally listed natural area. Sinking Pond covers about 150 to 200 acres and is six to seven feet deep. During summer months water drains into the ground, hence, the name Sinking Pond (Whitehead, 1984). Crumpton Creek is also a drainage stream for the AEDC Retention Reservoir. Crumpton Creek empties into the Duck River approximately nine miles downstream of the reservoir dam.

Within the Elk River Drainage Basin to the east, southeast and south eight streams drain AEDC. Bradley, Brumalow and Rollins Creeks are the major drainage streams from AEDC to the Elk River. Dry Creek, Hardaway Branch, Saltwell Hollow, Spring Creek and Poorhouse Creek are minor streams which drain the AEDC area. Woods Reservoir, a man-made lake, receives water from Bradley, Dry, Brumalow and Rollins Creeks as well as from Hardaway Branch. Saltwell Hollow, Spring Creek and Poorhouse Creek empty into the Elk River downstream of the Woods Reservoir Dam.

One natural and one man-made drainage feature within the AEDC area and the Elk River Drainage Basin are significant. Goose Pond, a Federally listed natural area, drains into Dry Creek east of the AEDC plant area. The cooling water return ditch, a man-made drainage feature, receives cooling water from the Test Areas and empties into Rollins Creek.

Within the AEDC plant area surface-water drainage is controlled by storm sewers and ditches (Figure 3.5). There are two major cooling water return ditches. One ditch from the J-4 area in the northwest section of the plant area empties into the Retention Reservoir. Cooling water from other parts of the Test Area empties into another ditch which flows southwest to Rollins Creek. The cooling water in the latter ditch can be diverted, if needed, to the Retention Reservoir at a diversion structure.


AEDC
PLANT AREA SURFACE DRAINAGE MAP
TO BRADLEY CREEK AND SKIMMING POND
TO BRADLEY CREEK VIA DRY CREEK
TO BRUMALOW CREEK AND SKIMMING POND
TO ROLLINS CREEK
OD A1
OD C1
OD C2
OD D1
OD D2
OD E
OD F
OD H
RETURN DITCH
RETURN DITCH
J-4
DITCH
DIVERSION STRUCTURE
SECONDARY RESERVOIR
RETURN
WATER
COOLING
RETENTION RESERVOIR
CHEMICAL TREATMENT POND
DAM 2102
CRUMPTON CREEK
ADMINISTRATION & ENGINEERING BLDG
100
251
451
578
616
651
VKF
878
879
ETF
PWT
760
740
Mark I
1575
1578
1552
1545
1560
1527
1690
1697
1650
2104
2106
2107
2212
2218
2219
2220
2221
2222
2223
Fourth Street
Fifth Street
Sixth Street
Avenue E
Gate 5
Gate 2
Access Highway
LEGEND
SURFACE WATER DITCH
STORM SEWER
OD H OUTFALL DITCH DESIGNATION
SCALE 0 1600 FEET
SOURCE: AEDC INSTALLATION DOCUMENTS

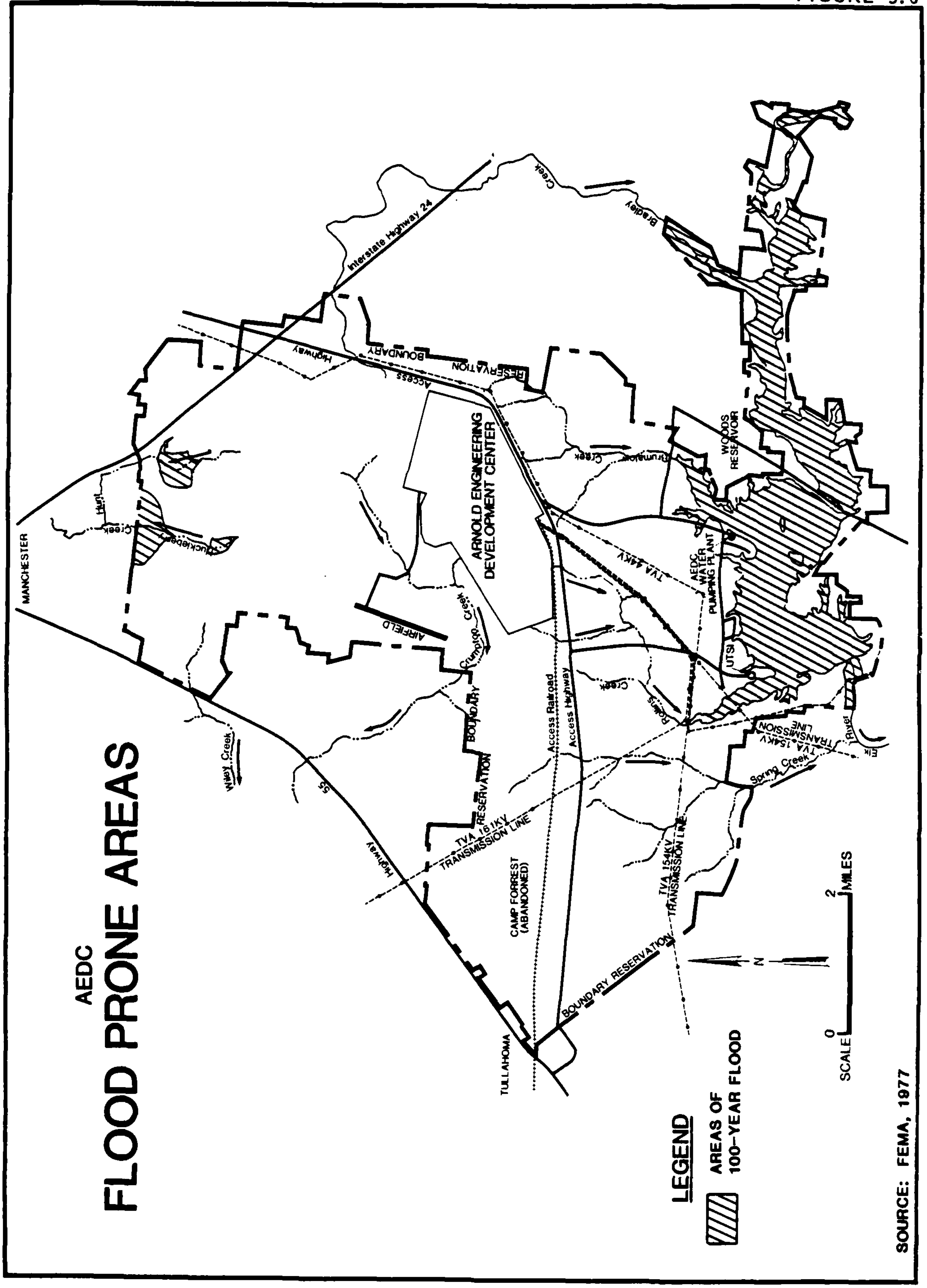
Storm sewers drain surface water from the center section of the plant area. Water from the storm sewers drain southeast to Brumalow Creek and north to outfall ditches. The outfall ditch "H" drains east where it joins other outfall ditches "C2," "D1," "D2," "E" and "F." These all drain to Bradley Creek. Outfall ditches "A1" and "C1" drain east to Dry Creek which empties into Bradley Creek. Skimming ponds for floating pollutant control are stationed on the AEDC installation within the Bradley Creek and Brumalow Creek watersheds.

The Retention Reservoir, another man-made lake, is located west of the plant area. The reservoir was built to retain cooling water until it cooled sufficiently to be released downstream and to also retain any pollutants that may be released during testing. The discharges from the reservoir (both normal and flood flows) are into Rollins Creek via the cooling water return ditch.

The only surface-water features at AEDC which may be affected by flooding are Woods Reservoir and Hunt and Huckleberry Creeks (FEMA, 1977). Figure 3.6 illustrates the expected extent of a 100-year flood in the area. The largest area of a 100-year flood is limited to Woods Reservoir.

Surface-Water Use

Surface-water use in the vicinity of AEDC includes domestic raw water supply, industrial water supply, propagation of fish and aquatic life, recreation, irrigation and livestock watering and wildlife (TNDPH, 1978). Of these, industrial water supply, recreation and wildlife are the major uses. Industrial water supply includes the cooling water intake for AEDC from Woods Reservoir. The daily average demand for non-potable water, including cooling, during 1974 was 97.8 million gallons. By comparison, the daily average demand for potable water (also obtained from Woods Reservoir) in 1974 was 0.793 million gallons. Recreation is another major surface-water use in the area. Woods Reservoir, a 3,980 acre lake, has 75 miles of shoreline and provides water recreation for the people of Coffee and Franklin Counties as well as many visitors to the area. Water used by wildlife is enhanced by the presence of Woods Reservoir and "The Barrens" wetland area. Within AEDC there is a U.S. Air Force Wildlife Management Area managed by The Tennessee Wildlife Resources Agency.


AEDC
FLOOD PRONE AREAS
MANCHESTER
TULLAHOMA
Interstate Highway 24
Highway 55
Access Highway
Access Railroad
RESERVATION BOUNDARY
BOUNDARY RESERVATION
ARNOLD ENGINEERING DEVELOPMENT CENTER
AIRFIELD
CAMP FORREST (ABANDONED)
TVA 161KV TRANSMISSION LINE
TVA 154KV TRANSMISSION LINE
TVA 44KV
AEDC WATER PUMPING PLANT
UTSI
WOODS RESERVOIR
Bradley Creek
Brumalow Creek
Crumpton Creek
Rollins Creek
Spring Creek
Elk River
Wiley Creek
Huckleberry Creek
Hunt Creek
SCALE
0
2
MILES
N
LEGEND
AREAS OF 100-YEAR FLOOD
SOURCE: FEMA, 1977

Surface-Water Quality

The general surface-water quality of both the Elk River and Duck River in the vicinity of AEDC is described as good (Tennessee Department of Public Health [TNDPH], 1978). Water quality data for industrial type pollutants are limited in this area.

Surface-water quality of discharges from AEDC are monitored at nine stations according to the National Pollutant Discharge Elimination System (NPDES). Figure 3.7 shows the location of these nine stations as well as an Elk River upstream and downstream sampling location. Table 3.3 summarizes selected water quality data from the monitoring locations.

At the Elk River upstream location near Dabbs Ford Bridge some minor elevated water quality levels above primary drinking water standards exist. At the upstream location as well as at the downstream location (Woods Reservoir Dam) water quality data gathered on a regular basis is limited. The downstream location analyses showed no adverse water quality.

At one sampling station on Woods Reservoir (AEDC Water Intake Pumping Plant) the water analyses for December 11, 1979 showed chromium (0.08 mg/l) to be greater than primary drinking water standards (0.05 mg/l). This result could also be sampling or analytical error. Analyses of finished tap water have not shown any adverse water quality.

Among the NPDES sampling stations at AEDC only the cooling water in Rollins Creek (TN 3751-001) is sampled for industrial pollutants on a regular basis. All other NPDES stations are sampled for flow and pollutants related to municipal wastewater discharges. The results in Table 3.3 indicate no adverse water quality data.

GROUND-WATER RESOURCES

The ground-water resources in the immediate vicinitv of AEDC are relatively abundant. The Manchester aquifer is the primary source of ground water in the area (Burchett, 1977). Reports by Theis (1936), Corps of Engineers (1962), Smith (1962), Burchett and Hollyday (1974), Dames and Moore (1975) and Burchett (1977) describe the ground-water resources of the area.

FIGURE 3.7

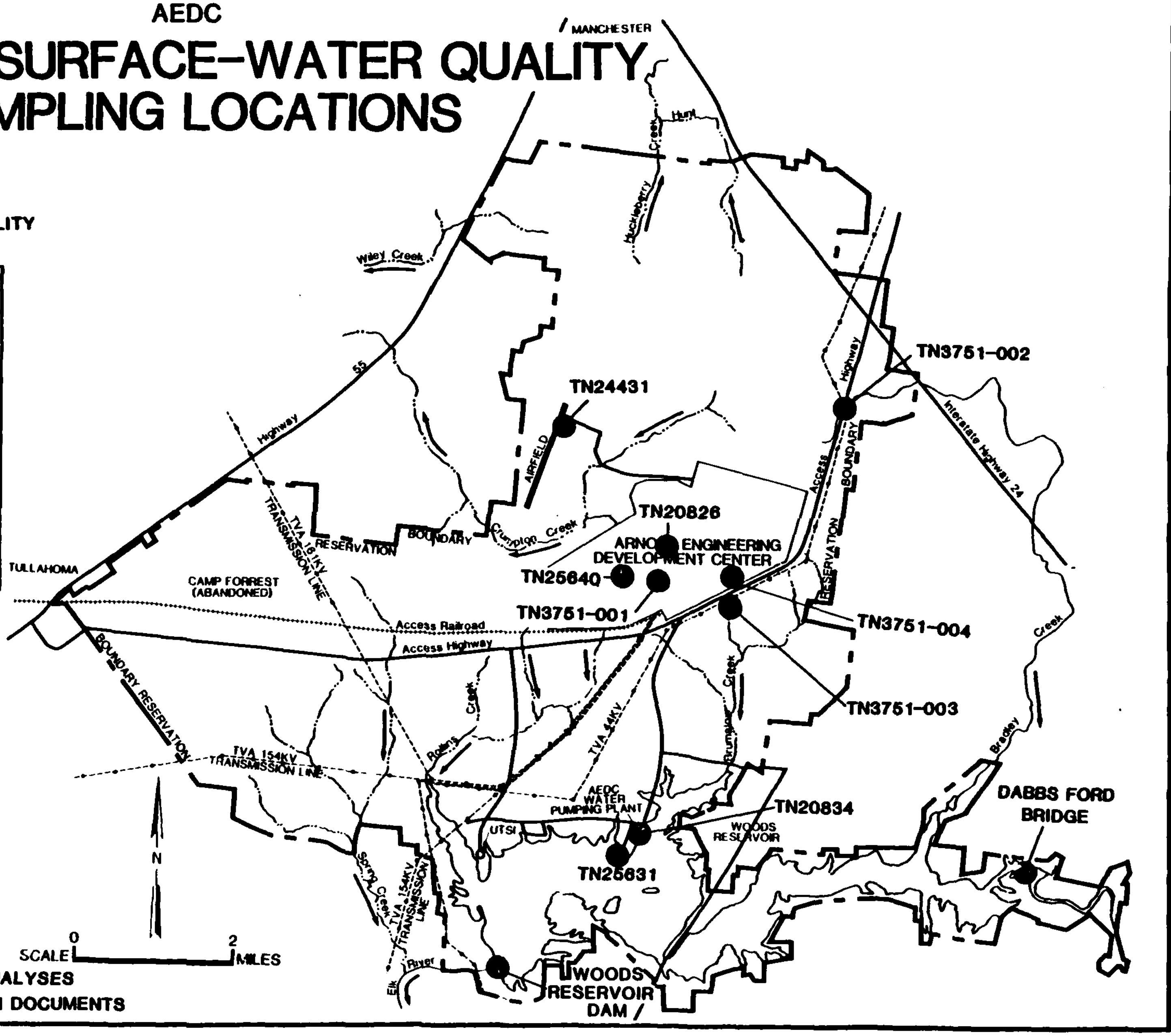
AEDC

SELECTED SURFACE-WATER QUALITY SAMPLING LOCATIONS

LEGEND

● SURFACE-WATER QUALITY SAMPLING LOCATION

NPDES No.	LOCATION
TN3751-001	Rollins Creek-Cooling Water
TN3751-002	Bradley Creek-Cooling Water
TN3751-003	Brumalow Creek-Cooling Water
TN3751-004	Cooling Tower-Cooling Water
TN20826	Main Sewage Treatment Plant
TN20834	Family Housing
TN24431	Airfield
TN25631	Officers Open Mess
TN25640	Rocket Preparation Area



NOTE: SEE TABLE 3.3 FOR ANALYSES

SOURCE: AEDC INSTALLATION DOCUMENTS

TABLE 3.3

SELECTED SURFACE-WATER QUALITY DATA FOR AEDC

Station Identification (number and/or location)	Sample Date (mn/dy/yr)	Water Quality Standards	pH (s.u.)	Total Al (mg/l)	Total Fe (mg/l)	Total Cr (mg/l)	Total Pb (mg/l)	Total Cn (mg/l)	Total Cu (mg/l)	Oil & Grease (mg/l)
			Selected Parameters							
		NPDES Daily Average	6.0 - 9.0	2.0	1.0	0.1	0.0025	0.0035	0.2	10.0
		Primary Drinking Water	NS	NS	NS	0.05	0.05	NS	NS	NS
Dabbs Ford Bridge	12/11/79 (G)		NA	0.1	0.2	0.07	ND	NA	ND	NA
Dabbs Ford Bridge	1/4/80 (G)		NA	0.7	0.6	ND	ND	NA	ND	NA
Dabbs Ford Bridge	2/23/84 (G)		7.9	NA	0.11	NA	ND	NA	0.06	NA
AEDC Water Intake Pumping Plant	12/11/79 (G)		NA	0.3	0.3	0.08	ND	NA	0.008	NA
AEDC Water Intake Pumping Plant	1/4/80 (G)		NA	0.1	0.5	ND	ND	NA	ND	NA
AEDC Water Intake Pumping Plant	2/23/84 (G)		8.3	NA	0.03	NA	ND	NA	0.004	NA
TN 3751-001 Cooling Water - Rollins Creek	12/-/81 (C)		7.6	NA	0.19	<0.01	<0.05	<0.02	0.02	1.0
TN 3751-001 Cooling Water - Rollins Creek	12/-/82 (C)		7.7	0.13	0.18	<0.01	<0.05	<0.02	0.03	0.2
TN 3751-001 Cooling Water - Rollins Creek	12/-/83 (C)		7.4	1.4	0.91	0.01	<0.05	<0.02	0.04	0.1
TN 3751-001 Cooling Water - Rollins Creek	4/-/84 (C)		7.2	0.2	0.24	<0.01	<0.05	<0.02	0.02	0.6
Woods Reservoir Dam	2/23/84 (G)		8.5	NA	ND	NA	ND	NA	0.004	NA

mn/dy/yr = month/day/year
s.u. = standard units
mg/l = milligrams per liter

G = grab sample
C = composite sample
NA = not analyzed

ND = not detected; detection limits are variable depending upon analytical techniques used.
NS = no standard

Source: AEDC Installation Documents

Hydrogeologic Units

Geologically, AEDC is located in the outcrop area of Quaternary age sediments and Mississippian and Devonian age rocks (Figure 3.8). A small southeastern portion of the installation is underlain at the surface by Alluvial Deposits. A much larger northern portion is underlain by the St. Louis and Warsaw Limestones. One area along Spring Creek and Rollins Creek is underlain by the Fort Payne and Chattanooga Formations. Table 3.4 summarizes the hydrogeologic units and their water-bearing characteristics. The Alluvial Deposits are composed of unconsolidated sand, silt and clay whereas the St. Louis, Warsaw, Ft. Payne and Chattanooga units are composed of consolidated rocks. The St. Louis is a dolomitic limestone; the Warsaw a bioclastic limestone and the Ft. Payne is a cherty limestone. The Chattanooga unit is a shale. The lithologic types of rocks underlying AEDC are a determining factor on the ground-water occurrences and movement. These factors will be discussed in the following sections.

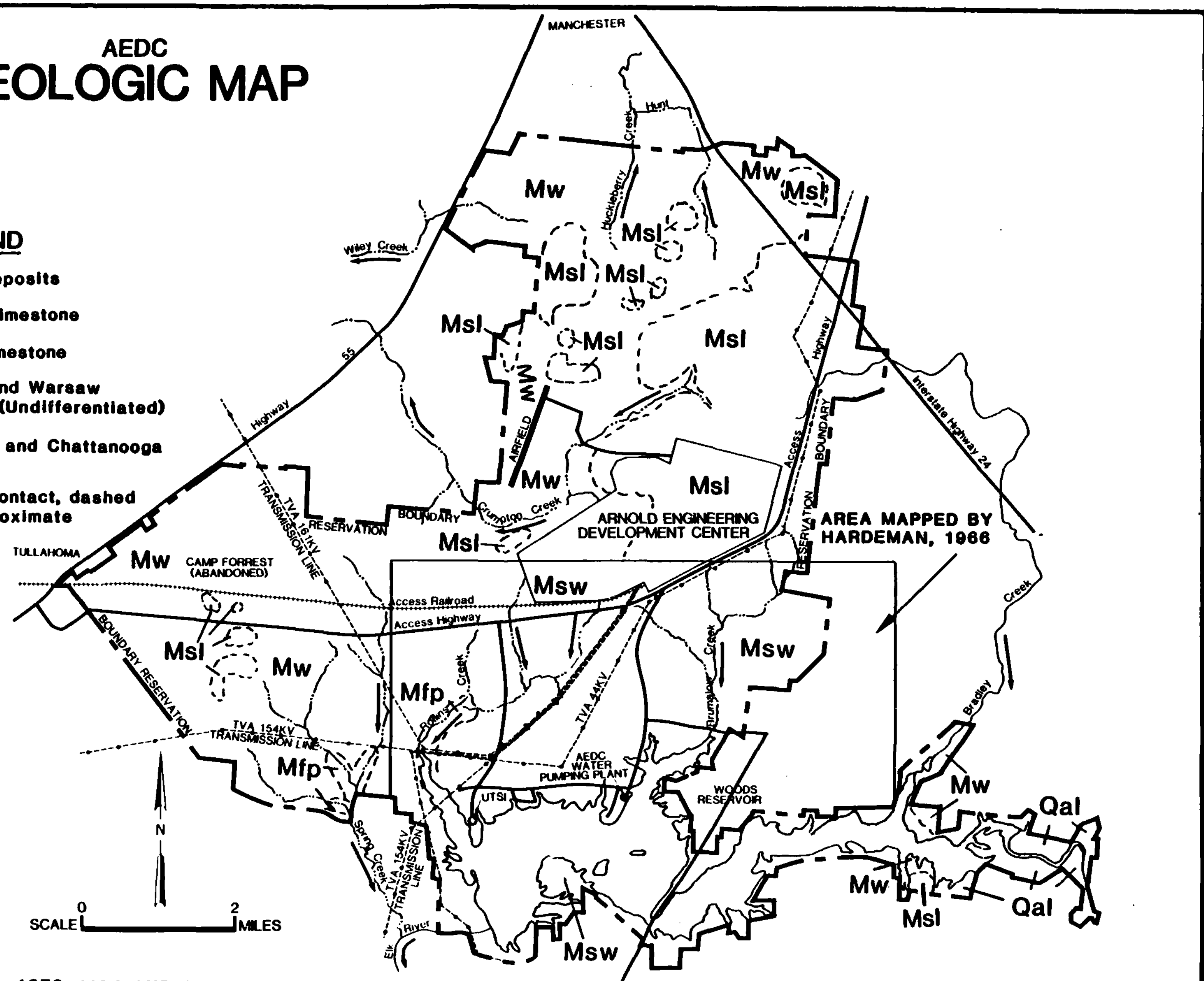
As an example of the lithologies underlying AEDC Figure 3.9 shows a typical test boring for the plant area. Clay is a dominant component from land surface to approximately 20 feet deep. Below 20 feet, clay is a less dominant component with varying amounts of sand, gravel, crushed gravel and rock fragments. Solid rock was encountered at 70 feet deep in the test boring. Although ground water was not recorded as encountered in the example boring, ground-water levels may vary from one foot to ten feet below land surface in the shallow aquifer and from one foot above land surface to 70 feet below land surface in the deeper Manchester aquifer. Figure 3.10 shows the location of two hydrogeologic cross sections in the plant area and Figures 3.11 and 3.12 illustrate the cross sections showing the Manchester aquifer. The shallow aquifer is not as distinct a unit as is the Manchester aquifer.

There are three general hydrogeologic units underlying AEDC. These are the shallow aquifers, the Manchester aquifer and the Chattanooga Shale, a confining bed. The shallow aquifers are composed of the Alluvial Deposits along stream channels and the shallow clay, sand and silt zones lying above the more dominant clay zones approximately 30 feet deep. The clay zones overly the clayey chert rubble zone of the Manchester aquifer. The shallow aquifers may consist of isolated,

AEDC
GEOLOGIC MAP

LEGEND

- **Qal** Alluvial Deposits
- **Msl** St. Louis Limestone
- **Mw** Warsaw Limestone
- **Msw** St. Louis and Warsaw Limestone (Undifferentiated)
- **Mfp** Fort Payne and Chattanooga Formations
- ---- Geologic Contact, dashed where approximate



SOURCE: WILSON, 1970, 1973 AND 1976; MOORE, 1977; HARDEMAN, 1966

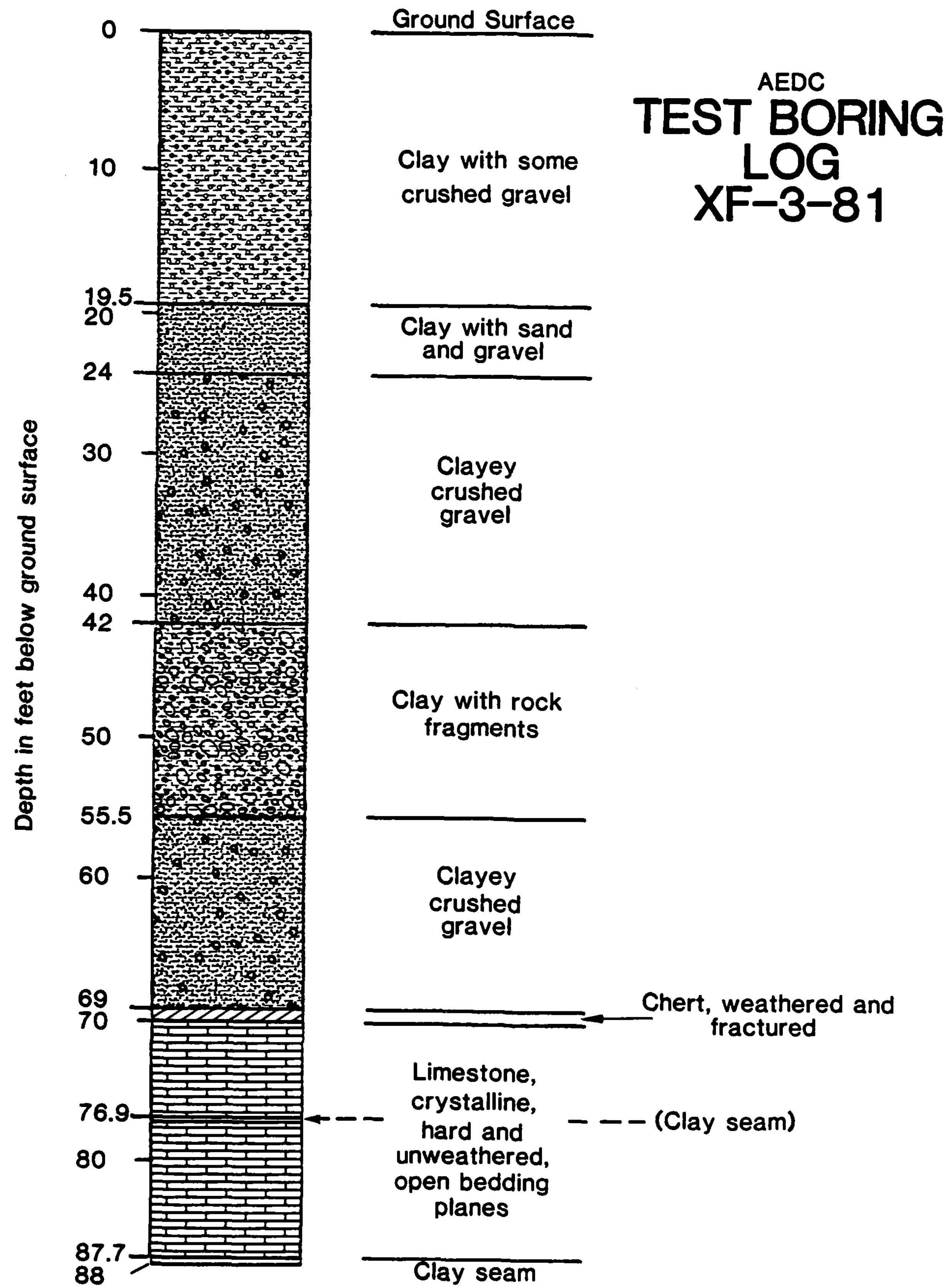
TABLE 3.4
HYDROGEOLOGIC UNITS AND THEIR WATER-BEARING CHARACTERISTICS
IN THE VICINITY OF AEDC

System	Series	Hydrogeologic Unit	Hydrogeologic Classification	Approximate Thickness	Dominant Lithology	Water-Bearing Characteristics
Quaternary	Pleistocene and Recent	Alluvial Deposits	Shallow aquifers (unconfined)	Less than 10	Unconsolidated sand, silt and clay	Readily transmits water, but deposits are limited to stream valleys.
Mississippian	Upper Mississippian	St. Louis Limestone	Manchester aquifer (confined)	60+	Dolomitic limestone	Readily transmits water in cherty rubble zone. Solution cavities are common with fair to good well yields. Well yields may vary from 20 to 300 gpm. Average transmissivity is 2,000 square feet per day. Springs may yield several thousand gpm.
		Warsaw Limestone		100	Bioclastic limestone	
	Lower Mississippian	Ft. Payne Formation		100-150	Cherty limestone	
Devonian	Upper Devonian	Chattanooga Shale	Confining bed	30	Shale	Does not readily transmit water. Lower confining bed for Manchester aquifer.

gpm = gallons per minute

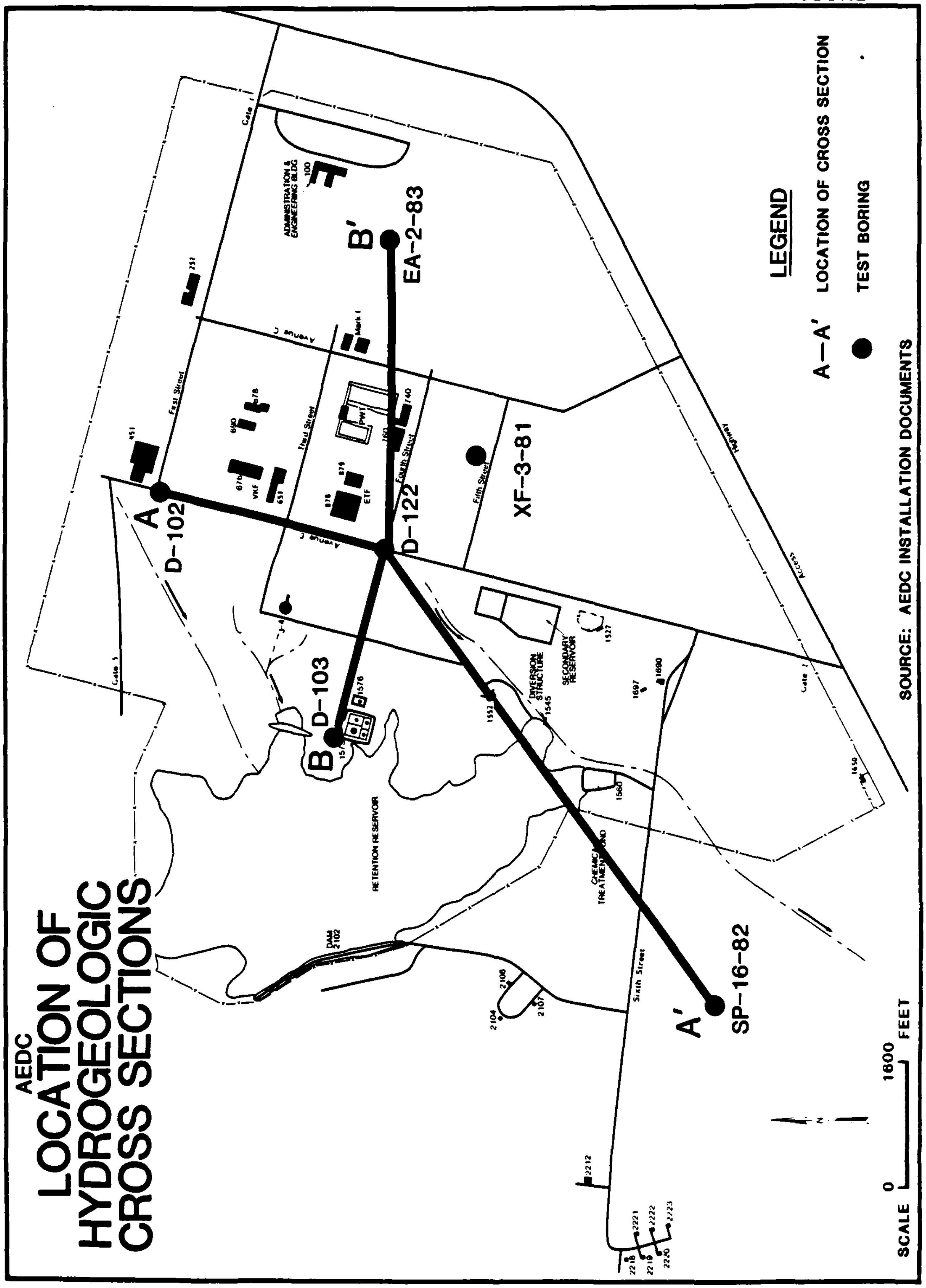
Source: Smith, 1962; Wilson, 1976; Burchett, 1977.

FIGURE 3.9



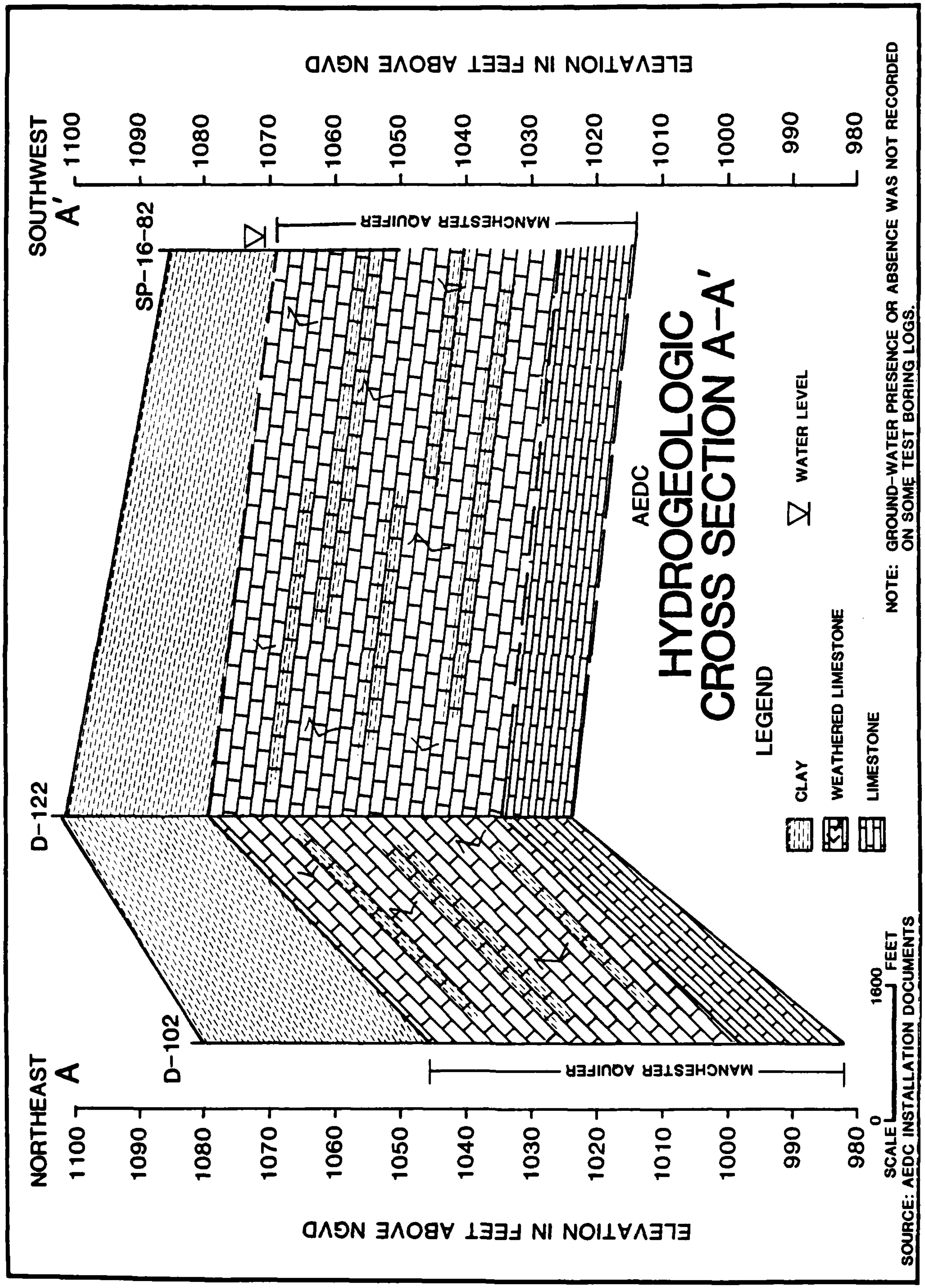
NOTE: SEE FIGURE 3.10 FOR TEST BORING LOCATION
SOURCE: AEDC INSTALLATION DOCUMENTS

FIGURE 3.10



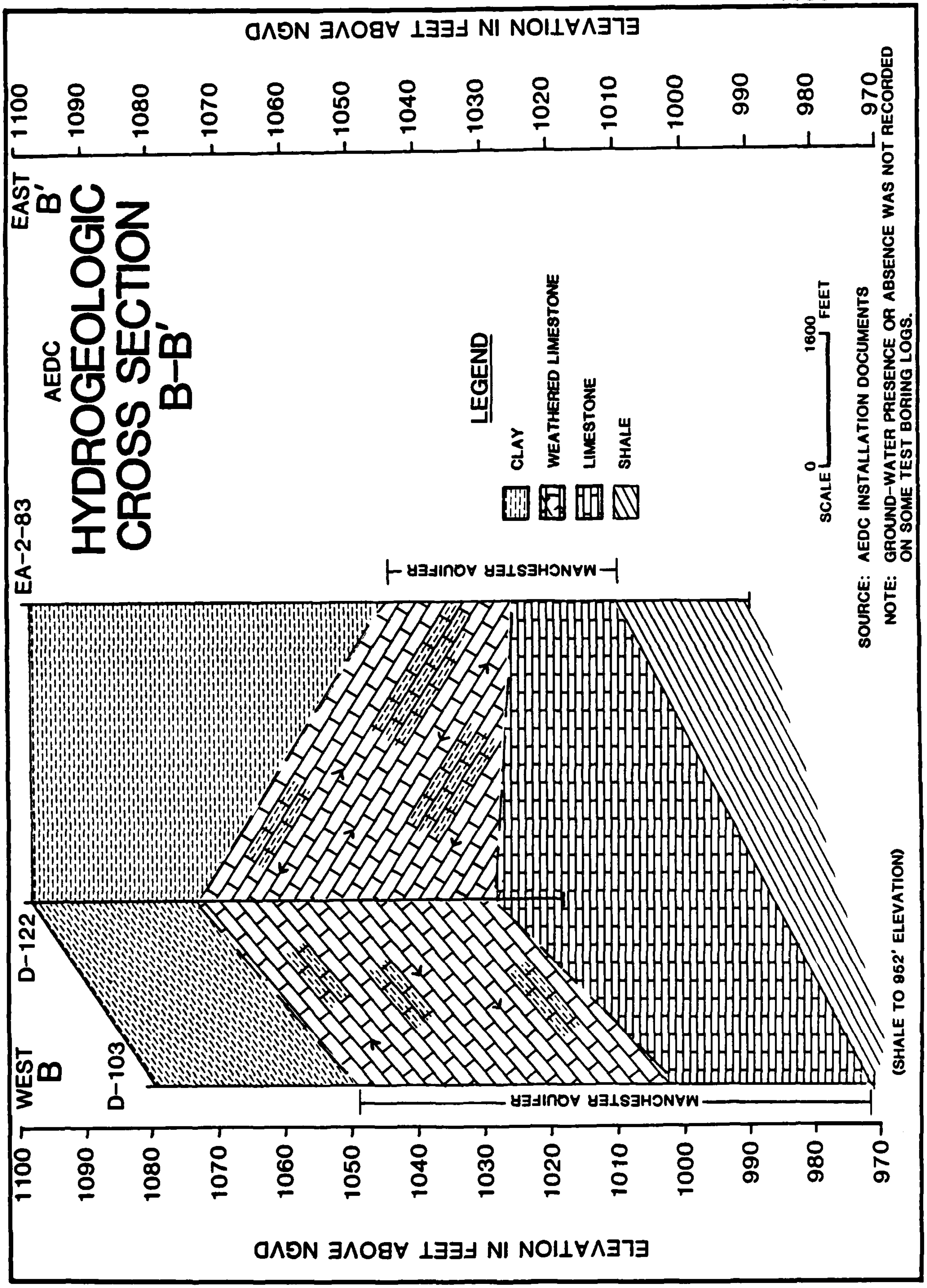
AEDC
LOCATION OF HYDROGEOLOGIC CROSS SECTIONS
LEGEND
A—A' LOCATION OF CROSS SECTION
TEST BORING
SOURCE: AEDC INSTALLATION DOCUMENTS
SCALE
0
1600 FEET
A
D-102
B
D-103
D-122
B'
EA-2-83
XF-3-81
A'
SP-16-82
ADMINISTRATION & ENGINEERING BLDG
100
RETENTION RESERVOIR
DAM 2102
CHEMICAL TREATMENT POND
DIVERSION STRUCTURE
1545
SECONDARY RESERVOIR
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Highway
Access
Gate 1
Gate 5
Gate 2
PWT
ETF
VKF

FIGURE 3.11



AEDC
HYDROGEOLOGIC CROSS SECTION A-A'

FIGURE 3.12


AEDC
HYDROGEOLOGIC CROSS SECTION B–B′
WEST
B
EAST
B′
D–103
D–122
EA–2–83
ELEVATION IN FEET ABOVE NGVD
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
MANCHESTER AQUIFER
(SHALE TO 952′ ELEVATION)
LEGEND
CLAY
WEATHERED LIMESTONE
LIMESTONE
SHALE
SCALE
0
1600
FEET
SOURCE: AEDC INSTALLATION DOCUMENTS
NOTE: GROUND–WATER PRESENCE OR ABSENCE WAS NOT RECORDED ON SOME TEST BORING LOGS.

seasonal perched water tables or may be continuous over large areas. The assumed ground-water flow directions in the shallow aquifers are similar to localized slopes in the topography. Discharge points would be lakes and streams. Where the clay layer is discontinuous, the shallow aquifer may allow ground-water recharge to the Manchester aquifer. The shallow aquifers may be completely dewatered in the plant area due to the pumpage of ground water which infiltrates from the J-4 and Mark I excavations. The excavations are approximately 250 feet deep and 80 feet wide and penetrate both the shallow aquifer and the Manchester aquifer. Ground-water monitoring wells in the vicinity of the Sanitary Landfill near the Retention Reservoir are approximately 30 feet deep and are screened in the shallow aquifer. All of these wells can be pumped dry indicating limited ground-water recharge and relatively low to moderate permeabilities. One permeability value was measured within the shallow aquifer in 1962 during the Mark II Chamber investigation. This value was 2.3×10^{-4} centimeters per second (cm/sec) (COE, 1962).

The second general hydrogeologic unit is the Manchester aquifer, so named by Burchett and Hollyday in 1974. The Manchester aquifer is composed of clayey chert rubble plus solution openings in the St. Louis, Warsaw and Ft. Payne units. The bioclastic limestone of the Warsaw unit is the most productive unit of the aquifer. The Manchester aquifer is a confined aquifer overlain by clay and underlain by the Chattanooga Shale. The confining nature of the Manchester aquifer near the ASTF Area was investigated by Dames and Moore in 1975. One conclusion was that a large variation in water-bearing capacity existed within the overall plant area. The hydraulic tests for the J-4 excavation yielded 122 gallons per minute (gpm), the tests for the Mark I excavation yielded 150 gpm, but the tests for the ASTF site only yielded 1.5 gpm. The same wide variation in water yields are reflected in yield variations from vicinity water wells tapping the Manchester aquifer. The Manchester aquifer is dewatered near the J-4 and Mark I test facilities within the plant area. Continuous pumping removes ground water from these areas. The radius of influence of the dewatering at the J-4 site is estimated to be 1,200 feet (COE, 1962). A radius of influence around the Mark I cell was estimated to be 400 feet (COE, 1962). Ground-water flow directions within the Manchester aquifer are not exactly known but

localized induced flows are expected within the radius of influence of the J-4 and Mark I dewatering.

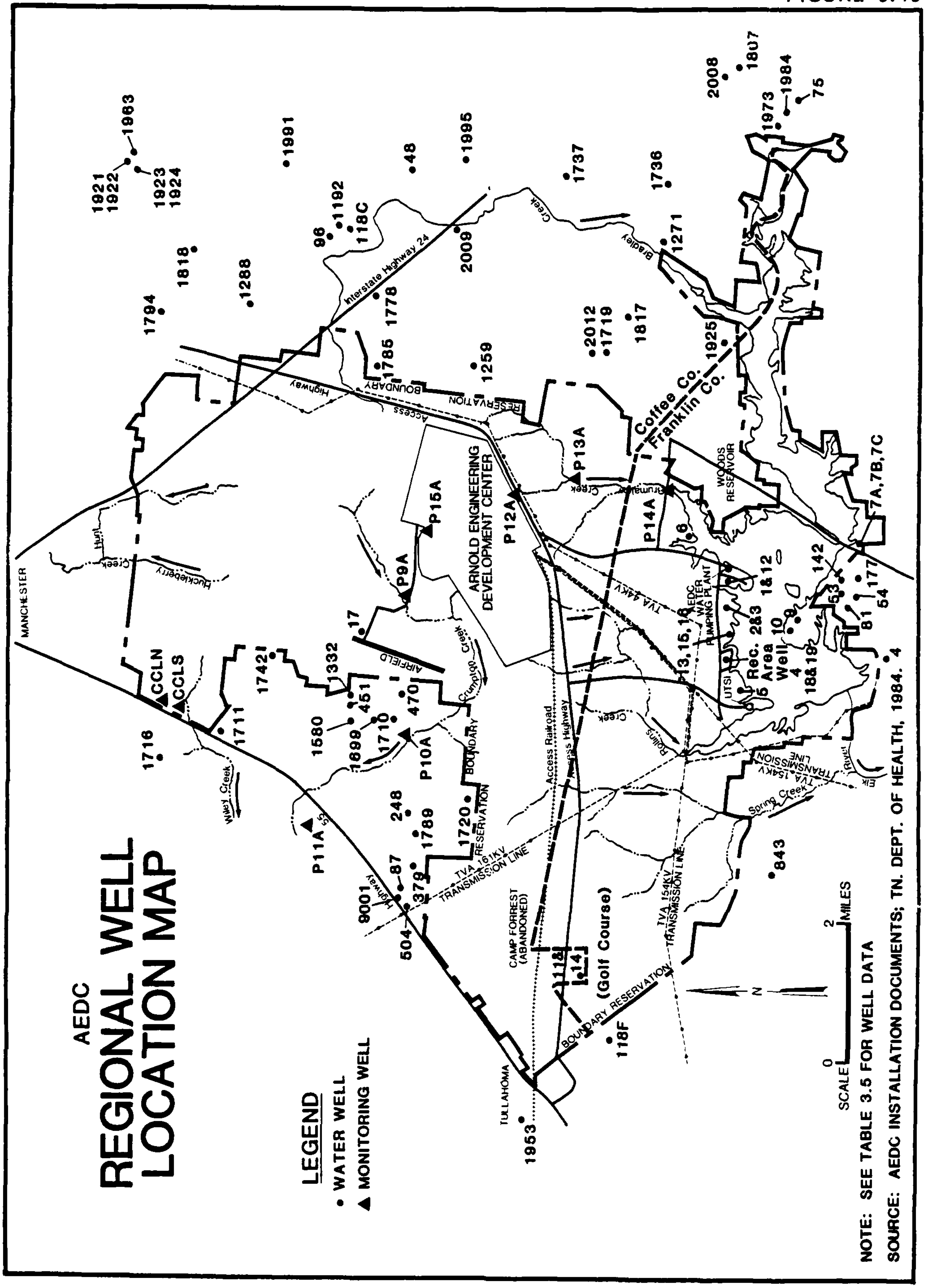
The third general hydrogeologic unit is the Chattanooga Shale, a major confining bed of the area. The shale confines the Manchester aquifer and as a result large volume natural springs exist where the shale is present just below the land surface. For example, Short Spring, supplying the Tullahoma, Tennessee water supply flows at 2,850 gpm (Burchett, 1977).

Ground-Water Use

Ground water is used as one source of public water supply at AEDC. All of the AEDC wells except the Golf Course Well (14) and the Airstrip Well (17) are located near Woods Reservoir. The location of these wells and other wells in the vicinity of AEDC are shown on Figure 3.13. The AEDC plant area has no drinking water wells but only wells for dewatering or monitoring purposes. Figure 3.14 shows these wells. Table 3.5 summarizes available data for these wells. The primary AEDC water supply wells tap the Manchester aquifer. Other wells with only hand pumps are probably tapping the shallow aquifer. The vicinity wells off AEDC property also tap the Manchester aquifer. These well yields vary from 3 to 100 gpm.

Ground-Water Quality

Ground-water quality in the vicinity of AEDC is generally good. Water from the Manchester aquifer is a calcium bicarbonate water or calcium sulfate water. The calcium and bicarbonate components are derived from the limestone while the sulfate component is a result of hydrogen sulfide gas (Burchett, 1977). Figure 3.15 shows the location of selected sampling wells in the AEDC area. Table 3.6 summarizes the ground-water quality data of the wells. The Manchester well (M-6) and the AEDC water supply wells have shown no adverse water quality problems. The monitoring wells at the Sanitary Landfill on the other hand have shown adverse water quality problems. Ground-water sampling has been conducted at the landfill for five and one-half years. The available analytical data are presented in Appendix D. Organic contaminants have been analyzed from well samples. Some selected contaminants are listed in Table 3.6.


AEDC
REGIONAL WELL
LOCATION MAP
LEGEND
• WATER WELL
▲ MONITORING WELL
ARNOLD ENGINEERING DEVELOPMENT CENTER
MANCHESTER
TULLAHOMA
Coffee Co.
Franklin Co.
WOODS RESERVOIR
CAMP FORREST (ABANDONED)
(Golf Course)
AIRFIELD
BOUNDARY RESERVATION
Interstate Highway 24
TVA 161KV TRANSMISSION LINE
TVA 154KV TRANSMISSION LINE
SCALE 0 2 MILES
N
NOTE: SEE TABLE 3.5 FOR WELL DATA
SOURCE: AEDC INSTALLATION DOCUMENTS; TN. DEPT. OF HEALTH, 1984.

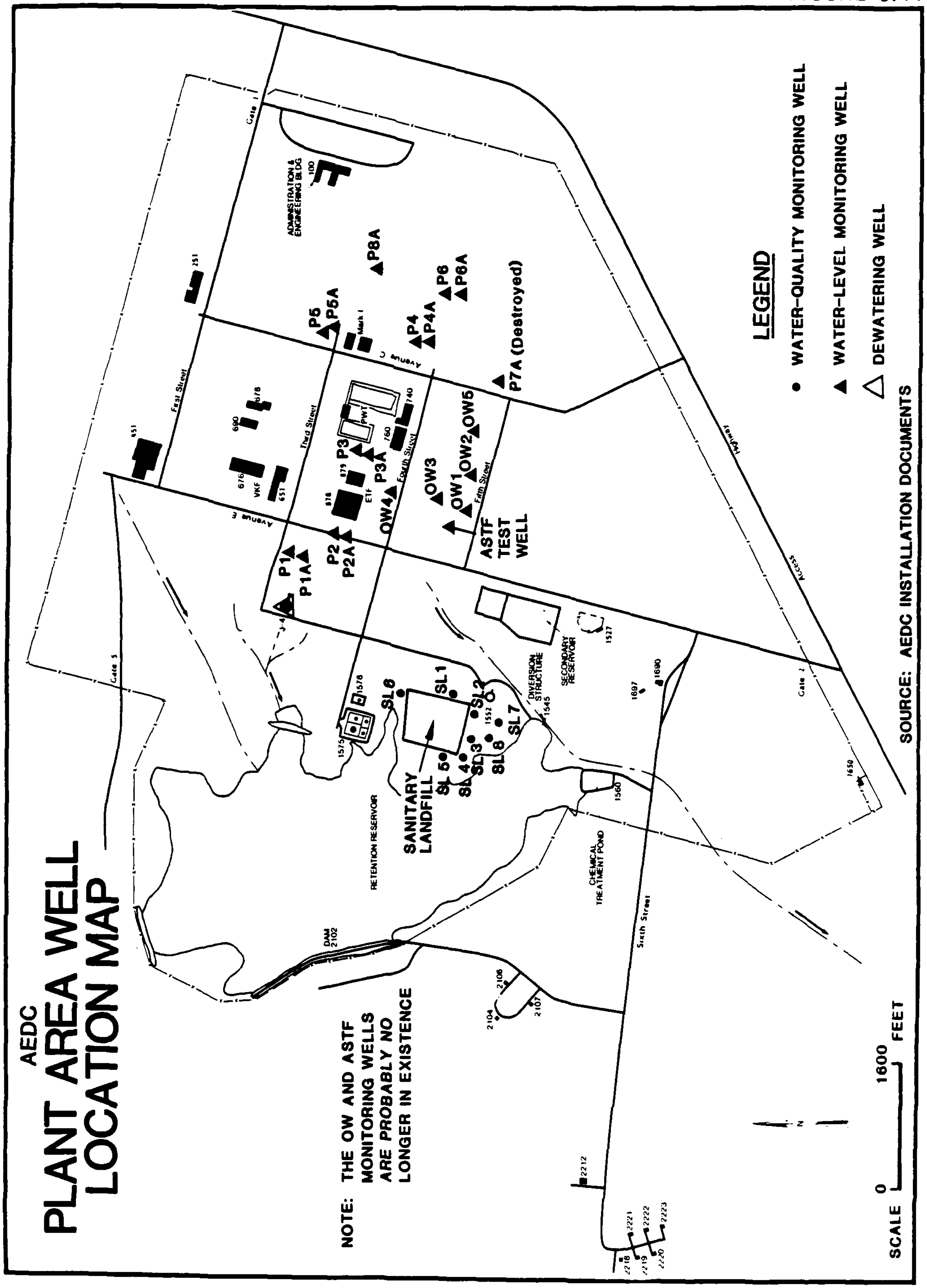

AEDC
PLANT AREA WELL LOCATION MAP
NOTE: THE OW AND ASTF MONITORING WELLS ARE PROBABLY NO LONGER IN EXISTENCE
LEGEND
● WATER-QUALITY MONITORING WELL
▲ WATER-LEVEL MONITORING WELL
△ DEWATERING WELL
SOURCE: AEDC INSTALLATION DOCUMENTS
SCALE 0 1600 FEET
ADMINISTRATION & ENGINEERING BLDG
100
251
451
676
678
690
651
VKF
Mark I
PWT
740
160
479
578
ETF
P1
P1A
P2
P2A
P3
P3A
P4
P4A
P5
P5A
P6
P6A
P8A
P7A (Destroyed)
OW1
OW2
OW3
OW4
OW5
ASTF TEST WELL
SL1
SL2
SL3
SL4
SL5
SL6
SL7
SL8
SANITARY LANDFILL
RETENTION RESERVOIR
DIVERSION STRUCTURE
SECONDARY RESERVOIR
CHEMICAL TREATMENT POND
DAM 2102
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Gate 1
Gate 2
Gate 5
Access Highway
1575
1578
1552
1545
1527
1697
1690
1560
1650
2104
2106
2107
2212
2218
2219
2220
2221
2222
2223

TABLE 3.5

WATER WELL DATA FOR AEDC AND VICINITY

Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface (1)	Yield (gpm)	Use
1	AEDC Arnold Village	10/25/58	96.9	NR	NR	6	MA	-34.9	50	PS
2	AEDC NCO Rec. Area	NR	NR	NR	NR	NR	NR	NR	NR	A
3	AEDC NCO Mess	10/23/61	75	NR	NR	6	MA	-34	5	NPS
4	AEDC Rec. Area	7/30/65	NR	NR	67.3	NR	MA	-23.5	13	NPS
5	AEDC Girl Scouts	NR	NR	NR	NR	NR	NR	NR	5	NPS
6	AEDC Coffee Co. Rec. Area	NR	NR	NR	NR	NR	NR	NR	HP	A
7A	AEDC Morris Ferry Dock	NR	NR	NR	NR	NR	NR	NR	11.4	PS
7B	AEDC Morris Ferry Dock	NR	NR	NR	NR	NR	NR	NR	11.4	PS
7C	AEDC Morris Ferry Dock	NR	NR	NR	NR	NR	NR	NR	11.4	PS
9	AEDC Franklin Co. Rec. Area	NR	NR	NR	NR	NR	NR	NR	11.4	PS
10	AEDC Boy Scouts	NR	NR	NR	NR	NR	NR	NR	HP	NPS
11	AEDC Golf Course	4/-/54	86	NR	NR	8	MA	-54	100	PS/Ir
12	AEDC Arnold Village	6/9/64	NR	NR	NR	8	MA	-54	60	PS
13	AEDC Campers Club	12/28/66	NR	NR	NR	NR	MA	-20	5	NPS
14	AEDC	NR	NR	NR	NR	NR	NR	NR	NR	A
15	AEDC	NR	NR	NR	NR	NR	NR	NR	NR	A
16	AEDC	NR	NR	NR	NR	NR	NR	NR	NR	A
17	AEDC Arnold Airstrip	5/-/69	65	10	75	6	MA	-16	11	NPS
18	AEDC Arnold Village	NR	NR	NR	NR	NR	NR	NR	HP	NPS
19	AEDC ARO Lodge	NR	NR	NR	NR	NR	NR	NR	25	NPS
SL1	AEDC Sanitary Landfill	1983	27	10	37	6	NR	-14.6 (6/6/84)	NR	QLM

TABLE 3.5
(Continued)
WATER WELL DATA FOR AEDC AND VICINITY

Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface(1)	Yield (gpm)	Use
SL2	AEDC Sanitary Landfill	1983	25	10	26	6	NR	-11.8 (6/6/84)	NR	QLM
SL3	AEDC Sanitary Landfill	1983	15	10	25	6	NR	-1.4 (6/6/84)	NR	QLM
SL4	AEDC Sanitary Landfill	1983	18	10	28	6	NR	-4.3 (6/6/84)	NR	QLM
SL5	AEDC Sanitary Landfill	1983	19	10	29	6	NR	-5.8 (6/6/84)	NR	QLM
SL6	AEDC Sanitary Landfill	1983	24	10	34	6	NR	-11.7 (6/6/84)	NR	QLM
SL7	AEDC Sanitary Landfill	1983	16	10	26	6	NR	-2.5 (6/6/84)	NR	QLM
SL8	AEDC Sanitary Landfill	1983	14.5	10	24.5	6	NR	-1.3 (6/6/84)	NR	QLM
CCLN	AEDC Coffee Co. Landfill	10/7/81	NR	NR	77	NR	MA	-50.5	2	QLM
CCLS	AEDC Coffee Co. Landfill	NR	NR	NR	70	NR	MA	NR	NR	QLM
JP4	AEDC JP4 Test Well	2/-/60	NR	NR	NR	20	MA	NR	24	LM
P1	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM
P1A	AEDC Plant Area	1962	68.6	4.4	73	2	MA	-10	NR	LM
P2	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM
P2A	AEDC Plant Area	1962	59.6	4.4	64	2	MA	-16	NR	LM
P3	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM
P3A	AEDC Plant Area	1962	71.6	4.4	76	2	MA	-16	NR	LM
P4	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM
P4A	AEDC Plant Area	1962	70.6	4.4	75	2	MA	-28	NR	LM
P5	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM
P5A	AEDC Plant Area	1962	NR	4.4	NR	2	MA	NR	NR	LM
P6	AEDC Plant Area	1962	40.6	4.4	45	2	NR	NR	NR	LM

TABLE 3.5
(Continued)
WATER WELL DATA FOR AEDC AND VICINITY

Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface(1)	Yield (gpm)	Use
P6A	AEDC Plant Area	1962	NR	4.4	NR	2	MA	NR	NR	LM
P7A	AEDC Plant Area	1962	30.6	4.4	35	2	MA	-8	NR	LM/DES
P8A	AEDC Plant Area	1962	NR	4.4	NR	2	MA	NR	NR	LM
P9A	AEDC Plant Area	1962	NR	4.4	NR	2	MA	-17.4 (11/15/62)	NR	LM
P10A	AEDC Plant Area	1962	12.6	4.4	17	2	MA	-6.9 (11/15/62)	NR	LM
P11A	AEDC Plant Area	1962	14.6	4.4	19	2	MA	-4.6 (11/15/62)	NR	LM
P12A	AEDC Plant Area	1962	45.6	4.4	50	2	MA	+0.7 (11/15/62)	NR	LM
P13A	AEDC Plant Area	1962	18.6	4.4	23	2	MA	-4.5 (11/15/62)	NR	LM
P14A	AEDC Plant Area	1962	44.6	4.4	49	2	MA	-1.7 (11/15/62)	NR	LM
P15A	AEDC Plant Area	1962	63.6	4.4	68	2	MA	-16.5 (11/15/62)	NR	LM
P16A	AEDC Plant Area	1962	25.6	4.4	30	2	MA	-31 (11/15/62)	NR	LM
TW	AEDC ASTF Area	1975	35	15	50	6	MA	-17.5	1.5	LM
OW1	AEDC ASTF Area	1975	41	10	51	4	MA	-19.4	NR	LM
OW2	AEDC ASTF Area	1975	41	10	51	4	MA	-20.2	1.0	LM
OW3	AEDC ASTF Area	1975	41	10	51	4	MA	-20.1	NR	LM
OW4	AEDC ASTF Area	1975	41	10	51	4	MA	-28.9	NR	LM
OW5	AEDC ASTF Area	1975	67	3	70	4	MA	-26.3	1.0	LM
4	D. Finney	8/14/63	NR	NR	70	6	MA	NR	50	D
48	M. Johnson	NR	NR	NR	89	2	MA	-69	6	D
53	B. Moreland	4/24/64	60	NR	78	6	MA	-44	30	D
54	H. Tucker	4/30/64	66	NR	73	4	MA	-40	16	D

TABLE 3.5
(Continued)
WATER WELL DATA FOR AEDC AND VICINITY

Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface(1)	Yield (gpm)	Use
75	A. Sherrill	NR	NR	NR	156	6	MA	-40	3	D
81	C. Seals	7/22/64	NR	NR	90	6	MA	NR	NR	D
87	M. Daniel	5/29/64	50	NR	65	5	MA	-33	15	D
96	M. Lester	NR	NR	NR	86	6	MA	-30	20	D
118C	Hillsboro Baptist Church	NR	NR	NR	78	6	MA	-47	10	Ch
118F	W. Hill	7/9/64	55	NR	72	5	MA	-50	16	D
142	Lightfoot	5/29/65	NR	NR	84	4	MA	-45	10	D
177	M. Campion	10/7/65	NR	NR	84	6	MA	-39	35	D
248	L. Bennett	4/12/66	65	NR	80	6	MA	-58	15	D
379	S. Ayers	3/20/67	52	NR	54	6	MA	-20	20	D
451	J. Myers	3/9/68	NR	NR	100	5	MA	-70	10	D
470	J. Blackburn	6/10/67	110	NR	113	6	MA	-70	20	D
504	R. Bryan	11/-/67	95	NR	101	6	MA	-70	15	D
843	T. Towery	8/1/74	70	NR	77	6	MA	-50	15	D
1192	L. B. Myers	NR	NR	NR	80	6	MA	-4	12	D
1259	E. Riddle	8/29/74	107	NR	112	6	MA	-72	10	D
1271	R. Hill	NR	NR	NR	78	6	MA	-18	20	D
1288	B. Lastor	NR	NR	NR	102	6	MA	NR	5	A
1332	W. Rhotell	11/12/76	96	NR	102	6	MA	-30	10	D
1580	J. Myers	4/20/79	125	NR	137	6	MA	-40	NR	Fm
1699	J. Sanders	7/26/79	52	NR	61	6	MA	-37	20	D

TABLE 3.5
(Continued)
WATER WELL DATA FOR AEDC AND VICINITY

Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface(1)	Yield (gpm)	Use
1710	D. Dugan	3/6/80	NR	NR	64	6	MA	-41	18	D
1711	Tractor Services	2/14/80	58	NR	63	6	MA	NR	20	I
1716	V. Casteel	7/14/80	NR	NR	59	6	MA	-18	10	Fm
1719	C. C. Farris	5/14/80	72	NR	73	6	MA	-15	10	D
1720	A. Greggs	7/19/79	35	NR	45	6	MA	-20	NR	D
1736	R. Waldron	NR	NR	NR	78	6	MA	-51	20	D
1737	J. Gilmore	NR	NR	NR	120	6	MA	NR	NR	D
1742	J. Parsons	8/27/80	45	NR	123	6	MA	-23	3	A
1778	T. Hickerson	NR	NR	NR	95	6	MA	-75	100	D
1785	G. Finney	1/9/81	85	NR	86	6	MA	-67	15	D
1789	H. Smith Nursery	5/12/81	60	NR	62	6	MA	-30	52	I
1794	L. Roberts	NR	NR	NR	63	6	MA	-32	17	D
1807	C. Gipson	NR	NR	NR	77	6	MA	-30	NR	D
1817	B. Randolph	7/25/80	60	NR	65	6	MA	-40	30	D
1818	N. Finney	NR	NR	NR	65	6	MA	-30	30	D
1921	J. McCullough	NR	NR	NR	90	NR	MA	-45	NR	D
1922	J. McCullough	NR	NR	NR	80	NR	MA	NR	0	NR
1923	J. McCullough	NR	NR	NR	145	6	MA	-45	8	D
1924	J. McCullough	NR	NR	NR	60	6	MA	-26	NR	D
1925	D. Weaver	12/29/81	54	NR	84	6	MA	-18	15	D
1953	G. L. Morris	6/27/82	NR	NR	87	6	MA	-48	50	D

TABLE 3.5
(Continued)
WATER WELL DATA FOR AEDC AND VICINITY

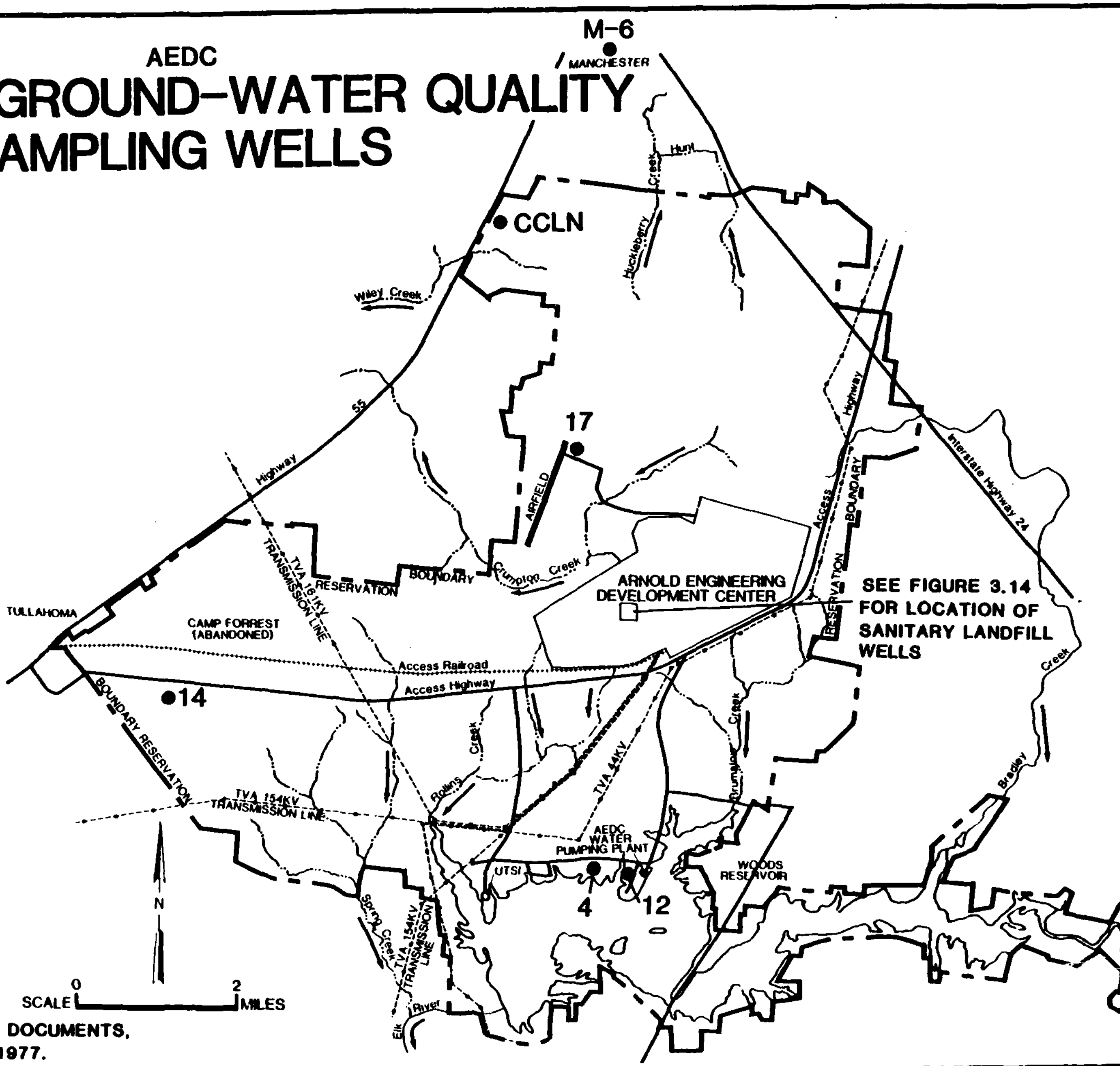
Well ID	Owner	Date Drilled (mn/day/yr)	Depth (feet) Casing	Depth (feet) Screen	Depth (feet) Total	Diameter (inches)	Hydrogeologic Unit(s) Tapped By Well	Water Level (feet) Above(+) or Below(-) Land Surface[(1)]	Yield (gpm)	Use
1963	R. Allison	NR	NR	NR	80	6	MA	-50	7	Fm
1973	O. Bean	NR	NR	NR	65	6	MA	-40	30	Fm
1984	J. Marlow	NR	NR	NR	85	6	MA	-40	5	D
1991	R. Pennegar	NR	NR	NR	115	6	MA	-60	5	D
1995	F. Starks	NR	NR	NR	65	6	MA	-40	25	D
2008	R. Boyett	NR	NR	NR	105	6	MA	-50	100	Fm
2009	R. Harris	NR	NR	NR	70	6	MA	-40	20	Fm
2012	C. Redmon	5/12/82	65	NR	70	6	MA	-40	50	D
9001	L. Oldfield	1954	53	NR	68	6	MA	-53	15	D

NOTES: (1) Water level measurement date is date well was drilled unless otherwise stated.

A = abandoned
C = Coffee County
Ch = church
D = domestic
DES = destroyed
F = Franklin County
Fm = farm
gpm = gallons per minute
HP = hand pump
ID = identification
I = industrial
Ir = irrigation
LM = water level monitoring
MA = Manchester aquifer
mn/dy/yr = month/day/year
NPS = non-public supply
NR = not recorded
PS = public supply
QLM = water quality and level monitoring

Source: AEDC Installation Documents; Tennessee Department of Public Health, 1984.

AEDC
SELECTED GROUND-WATER QUALITY SAMPLING WELLS



LEGEND

● GROUND-WATER QUALITY SAMPLING WELL

CCLN-	AEDC Coffee County Landfill
M-6-	Manchester, TN.
4-	AEDC NCO Club
12-	AEDC Arnold Village
14-	AEDC Golf Course
17-	AEDC Air Strip

SOURCE: AEDC INSTALLATION DOCUMENTS, TVA, 1983; TNDPH, 1977.

TABLE 3.6

SELECTED GROUND-WATER QUALITY DATA FOR AEDC AND VICINITY

Well Identification (number/location)	Sample Date (mn/dy/yr)	pH (s.u.)	Specific Conductance (umhos/cm)	Cr[1] (mg/l)	Pb[1] (mg/l)	TOC (ug/l)	1,1,1 Tri-chloroethane (ug/l)	Tetrachloro-ethylene	Trichloro-ethylene (ug/l)
			Selected Parameters						
M-6/Manchester, TN	NR	7.1	160	<0.005	0.019	NA	NA	NA	NA
12/AEDC Arnold Village	9/16/83	NA	NA	<0.05	<0.02	NA	NA	NA	NA
4/AEDC NCO Club	9/16/83	NA	NA	<0.05	<0.02	NA	NA	NA	NA
14/AEDC Golf Course	1/17/84	NA	NA	<0.05	<0.02	NA	NA	NA	NA
17/AEDC Air Strip	9/20/83	NA	NA	<0.05	<0.02	NA	NA	NA	NA
CCLN/Coffee Co. Landfill	2/9/77	6.1	NA	NA	NA	<1	NA	NA	NA
1/AEDC Sanitary Landfill	2/1/84[2]	7.2	149.5	<0.01	<0.05	<2	<5	<7	<5
2/AEDC Sanitary Landfill	2/1/84[2]	6.2	1025.3	<0.01	<0.05	64.5	8,887	63,648	71,097
3/AEDC Sanitary Landfill	2/1/84[2]	6.9	432.3	<0.01	<0.05	<2	66	170	16
4/AEDC Sanitary Landfill	2/1/84[2]	6.8	581.3	<0.01	<0.05	3.8	6,613	262	9
5/AEDC Sanitary Landfill	2/1/84[2]	10.8	464.5	0.02	<0.05	<2	36	2,293	37
6/AEDC Sanitary Landfill	2/1/84[2]	6.8	321.8	<0.01	<0.05	<2	27	10	<4
7/AEDC Sanitary Landfill	2/1/84[2]	7.0	424.8	<0.01	<0.05	<2	162	3,104	2,810
8/AEDC Sanitary Landfill	2/1/84[2]	7.1	427.0	<0.01	<0.05	<2	1,199	1,840	7,139

mn/dy/yr = month/day/year
s.u. = standard units
umhos/cm = micromhos per centimeter
mg/l = milligrams per liter

ug/l = micrograms per liter
TOC = Total Organic Carbon
NA = Not analyzed
NR = No Record

Notes: (1) Primary Drinking Water Standard is 0.05 mg/l.
(2) Sampling analyses have been taken for the past several years - see Appendix D for available data.

Source: AEDC Installation Documents; TVA, 1983.

BIOTIC ENVIRONMENT

The biotic environment of AEDC is enhanced by the presence of the U.S. Air Force Wildlife Management Area managed by the Tennessee Wildlife Resources Agency. The area covers 36,000 acres and affords the protection of certain plant and animal species as well as the controlled hunting of deer, turkey and duck. Rare plants such as Death Camas, Rose Pogonia and Ragged Fringed orchids, Grass Pink and Sundew are found on the AEDC property. The Gray Bat, found at the Woods Reservoir Dam, is an endangered species (Whitehead, 1984). Also the Osprey, another endangered species, has been populated at the Retention Reservoir on a limited basis. It is not a permanent resident of AEDC.

Due to the presence of the Wildlife Management Area at AEDC, studies have been conducted and are presently in progress which identify species of particular interest and which attempt to identify specific problems related to plant and animal growth. One such study deals with the presence of PCB in fish. This study is now in progress. Also another study underway deals with the growth of aquatic plants in the creeks of AEDC (Whitehead, 1984).

SUMMARY OF ENVIRONMENTAL SETTING

The environmental setting data for AEDC indicate the following data are important when evaluating past hazardous waste disposal practices.

1. The mean annual precipitation is 54.17 inches; the net precipitation is +17.17 inches and the one-year, 24-hour rainfall event is estimated to be 3.1 inches. These data indicate that there is a moderate potential for precipitation to infiltrate the surface soils. Also, there is a moderate potential for runoff and erosion.
2. The natural soils on the installation are typically well drained loam and combinations of cherty, silty and clayey loam with moderate permeabilities.
3. Surface water, an abundant resource of AEDC, is controlled by underground storm sewers, open ditches, streams and man-made reservoirs.

4. The primary water source for AEDC drinking water and process water is Woods Reservoir which is on the installation. Some small wells serve isolated facilities on the installation with potable water.
5. A shallow aquifer of limited extent and permeability exists locally within 30 feet of land surface. The shallow aquifer is isolated in most places and is not used as a main source of ground water.
6. A shallow confining clay bed underlies the uppermost aquifer and separates it from the deeper Manchester aquifer. The clay bed may be discontinuous in some parts of AEDC and allow ground-water recharge into the Manchester aquifer.
7. The Manchester aquifer, a major confined aquifer of the area is a primary source of ground water for water users of AEDC as well as local farms and municipalities.
8. The shallow aquifer and the Manchester aquifer are dewatered immediately adjacent to the JP-4 vertical rocket test cell and Mark I aerospace chamber due to continuous pumping from sumps around the test facilities.
9. The Chattanooga Shale, a major confining bed of the area, is the lower confining unit for the Manchester aquifer.
10. The Gray Bat is a Federally and State listed endangered species which inhabits the Elk River Dam.
11. AEDC comprises a U.S. Air Force Wildlife Management Area with two Federally listed Natural Areas (Sinking Pond and Goose Pond).

A review of these major findings indicates that pathways for the migration of hazardous waste-related contamination exist. Contaminants present at ground surface would likely be mobilized to local drainage alignments via the shortest flow path. The shallow aquifers present have moderate permeabilities and are isolated in most places from the deeper more important Manchester aquifer by a confining bed of clay. The ground-water movement and contaminants if present in the shallow aquifers would probably favor a horizontal direction toward discharge points in streams and lakes. If the confining bed between the shallow

aquifers and the Manchester aquifer is discontinuous, contaminant migration may occur vertically into the Manchester aquifer and follow a horizontal flow path toward pumping centers such as the vertical test cell dewatering areas and local water wells.

SECTION 4

FINDINGS

This section summarizes the hazardous wastes generated by installation activities, identifies hazardous waste accumulation and disposal sites located on the installation, and evaluates the potential environmental contamination from hazardous waste sites. Past waste generation and disposal methods were reviewed to assess hazardous waste management practices at Arnold Engineering Development Center.

INSTALLATION HAZARDOUS WASTE ACTIVITY REVIEW

A review was made of past and present installation activities that resulted in generation, accumulation and disposal of hazardous wastes. Information was obtained from files and records, interviews with past and present installation employees and site inspections.

The sources of hazardous waste at AEDC are grouped into the following categories:

- Industrial Operations (Shops)
- Waste Accumulation and Storage Areas
- Fuels Management
- Spills and Leaks
- Pesticide Utilization
- Fire Protection Training

The subsequent discussion addresses only those wastes generated at AEDC which are either hazardous or potentially hazardous. Potentially hazardous wastes are grouped with and referenced as "hazardous wastes" throughout this report. A hazardous waste, for this report, is defined by, but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). For study purposes, waste

petroleum products such as contaminated fuels, waste oils and waste solvents are also included in the "hazardous waste" category.

No distinction is made in this report between "hazardous substances/materials" and "hazardous wastes". A potentially hazardous waste is one which is suspected of being hazardous although insufficient data are available to fully characterize the material.

Industrial Operations (Shops)

Summaries of industrial operations at AEDC were developed from installation files and interviews. Information obtained was used to determine which operations handle hazardous materials and which ones generate hazardous wastes. Summary information on all installation shops is provided as Appendix E, Master List of Industrial Shops.

For the shops identified as generating hazardous wastes, file data was reviewed and personnel were interviewed to determine the types and quantities of materials and present and past disposal methods. Information developed from AEDC files and interviews with installation employees is summarized in Table 4.1.

Table 4.1 presents information on shop location, identification of hazardous or potentially hazardous waste, present waste quantities, and waste management timelines for AEDC. It is noted that the waste quantities reflect present conditions. Through interviews it is apparent that these waste characteristics and quantities at AEDC probably varied considerably from year to year depending on the number and the types of tests performed. Unused test propellants were in previous years disposed at various locations as discussed later. These wastes were highly variable and are not included in Table 4.1. Some shops generated larger quantities of waste in the 1950's and 1960's than currently, due to the intense efforts in support of the nation's space program. The research and development nature of the AEDC mission has made it a very dynamic installation as regards waste generation.

Hazardous wastes generated from AEDC industrial operations have been disposed of by several different methods and at several sites. The following is an overview of the methods used for handling shop wastes. These are discussed in more detail in later parts of this section.

In the 1950's waste materials were primarily disposed at the landfill/burning area ("fire pit") near Gate 5, the Model Shop leaching pit,

TABLE 4.1

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
FACILITY SUPPORT				
PRINT SHOP	100	RESIDUAL INK, DEVELOPER	1200 LBS./YR.	SANITARY SEWER
		PCB WASTE TRANSFORMER OIL	660 GALS./ONE TIME	1980 DPDO 1984
CARPENTER SHOP	1478	OLD CAULKING AND GLAZING	500 LBS./YR.	LANDFILL NO. 1; LANDFILL NO. 1/NO. 2; 1971 LANDFILL NO. 4
		USED CLEANER	12 LBS./YR.	SANITARY SEWER
PAINT SHOP	1478	SPENT CLEANING FLUID (NAPTHA, VARSOL, METHYL CHLOROFORM)	2400 LBS./YR.	1952 LANDFILL NO. 1; 1956 LANDFILL NO. 2; 1980 DPDO
		CONTAINERS AND RESIDUE	600 LBS./YR.	LANDFILL NO. 1; LANDFILL NO. 1/NO. 2; 1971 LANDFILL NO. 4
A/C SHOP (REFRIGERATION SHOP)	1478	SPENT SOLVENT & CLEANER	300 LBS./YR.	1953 SANITARY SEWER
		SPENT FILTERS	125/YR.	LANDFILL NO. 1; 1956 LANDFILL NO. 1/NO. 2; 1971 LANDFILL NO. 4
		FREON MF/TF & OIL MIXTURE	120 LBS./YR.	FPTA NO. 1; 1970 ROADS 1971; 1972 STEAM PLANT A
		REFRIGERATION OIL CANS AND RESIDUE	240 LBS./YR.	LANDFILL NO. 1/ BURN PIT NO. 1; 1956 BURN AREA NO. 1/ LANDFILL NO. 2; 1971 LANDFILL NO. 4
		SCALE CLEANER	300 LBS./YR.	SANITARY SEWER

KEY

———— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

------ ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
CUSTODIAL SERVICES (TEST CELL CLEANING)	1478	SPENT CLEANER & RESIDUAL	5000 LBS./YR.	1953 SANITARY SEWER
		CONTAINERS	2000 LBS./YR.	LANDFILL NO. 1; SALVAGED OR LANDFILL NO. 2; LANDFILL NO. 4
BUILDINGS & GROUNDS	1478	CONTAINERS & RESIDUAL (FLY SPRAY, RAT BAIT, TERMITE POISON, INSECTICIDE)	300 LBS./YR.	LANDFILL NO. 1; 1956 LANDFILL NO. 2; 1971 LANDFILL NO. 2/NO. 4
		WASTE PESTICIDE CONTAINERS	30/YR.	LANDFILL NO. 1; LANDFILL NO. 2
		BAGS, BOXES AND DISPOSABLE CLOTHING	600-700/YR.	LANDFILL NO. 1; LANDFILL NO. 2
PIPE SHOP	1478	ASBESTOS INSULATION	6000 LBS./YR.	1980 LANDFILL NO. 2
		WASTE SOLVENTS (KEROSENE, ACETONE, VARSOL)	1200 LBS./YR.	BURN AREA NO. 1/FPTA NO. 1; 1973 FPTA NO. 2/STEAM PLANT A
		WASTE CUTTING OILS	120 LBS./YR.	BURN AREA NO. 1/FPTA NO. 1; FPTA NO. 1/NO. 2
		WASTE CANS (SEALING COMPOUNDS) AND RESIDUALS	60 LBS./YR.	LANDFILL NO. 2; 1971 LANDFILL NO. 4
MECHANICAL MAINTENANCE SHOP	1478	ACID CLEANER (10 LBS. ACID TO 50 GALS. WATER)	200 LBS./YR.	SANITARY SEWER
		ALKALINE CLEANER (1:5 MIX)	10 GALS./YR.	SANITARY SEWER
		MISCELLANEOUS CLEANERS	150 GALS./YR.	1951 SANITARY SEWER

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
AUTO AND LOCOMOTIVE REPAIR SHOPS	1401, 1403	WASTE OILS, ETHYLENE GLYCOL, TRANSMISSION FLUID	1000 GALS./YR.	1953 BURN AREA NO. 1/ FPTA NO. 1; 1972 STEAM PLANT A
		WASTE CANS & RESIDUE	1000 LBS./YR.	LANDFILL NO. 1/NO. 2; 1971 LANDFILL NO. 4
		WASTE FILTERS	2400 LBS./YR.	FPTA NO. 1; FPTA NO. 2/ LANDFILL NO. 4
		WASTE GREASE	120 LBS./YR.	FPTA NO. 1; FPTA NO. 1/NO. 2
		KEROSENE WASTE	1200 LBS./YR.	BURN AREA NO. 1/ FPTA NO. 1; 1973 FPTA NO. 1/NO. 2
CHEMICAL/METALLURGICAL LAB	445	WASTE ACIDS	200 LBS./YR.	1962 SANITARY SEWER
		WASTE SOLVENTS	250 GALS./YR.	LEACHING PIT NO. 1; 1972 LEACHING PIT NO. 2; DPDO
		ASBESTOS	200 LBS./YR.	1980 LANDFILL NO. 2
		CHROMIUM & COMPOUNDS (CHROMIC ACID)	50 GALS./YR.	LEACHING PIT NO. 1; 1972 LEACHING PIT NO. 2; 1979 DPDO
		TOLUENE (75% TOLUENE & PAINT SLUDGE)	50 GALS./YR.	CAMP FORREST LEACHING PIT NO. 2; DPDO
X RAY PHOTO LAB	2108	MISCELLANEOUS CHEMICAL WASTE	100 GALS./YR.	1963 SEPTIC TANK/ SANITARY SEWER; 1966 SEPTIC TANK/ SILVER RECOVERY
		CAPACITORS (PCB CONTAMINATED)	65/ONE TIME	1980 DPDO 1984

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
FABRICATION & MAINTENANCE BRANCH	451	NITRIC (45%) and HYDROFLUORIC (2%) ACID IN SOLUTION	3000 GALS./YR.	1953 LEACHING PIT NO. 2; LEACHING PIT NO. 1; 1975; NEUTRALIZATION PRETREATMENT BASIN
		TURCO 4368 (PHOSPHORIC ACID)	3000 GALS./YR.	LEACHING PIT NO 1; LEACHING PIT NO. 1; NEUTRALIZATION PRETREATMENT; DPDO
		PERCHLOROETHYLENE	2000 GALS./YR.	MODEL SHOP SOLVENT RECOVERY; 1963; CAMP FORREST, LEACHING PIT NO. 2; 1980
		PERCHLOROETHYLENE	500 GALS./YR.	DPDO
		ALCOHOL-ISOPROPYL	500 GALS./YR.	BURN PIT NO. 1; FPTA NO. 1; DPDO/STEAM PLANT A
		HYDROCHLORIC ACID	600 LBS./YR.	LEACHING PIT NO. 1; LEACHING PIT NO. 2; NEUTRALIZATION PRETREATMENT
		ACETIC ACID	60 LBS./YR.	LEACHING PIT NO. 1; LEACHING PIT NO. 2; 1975; NEUTRALIZATION PRETREATMENT
PLATING AND HEAT TREATMENT	451	WASTE CHROME PLATING SOLUTION	50 GALS./YR.	LEACHING PIT NO. 1; 1956; LANDFILL NO. 2; 1980; DPDO
		BLACK OXIDE COATING	1600 LBS./YR.	DRAINAGE DITCH/LANDFILL NO. 2; DPDO
		HARDENING AND TEMPERING SALTS (Ba,Ca,Na CHLORIDES)	1200 LBS./3 5 YRS.	LANDFILL NO. 1; LANDFILL NO. 2
		HARDENING AND TEMPERING SALTS (Na,K NITRATES)	350 LBS./3 5 YRS.	LANDFILL NO. 1; 1956; LANDFILL NO. 2
		PERCHLOROETHYLENE	150 GALS./YR.	MODEL SHOP SOLVENT RECOVERY; 1963; CAMP FORREST; 1980; DPDO
		ELECTROLESS NICKEL SOLUTION	1000 GALS./YR.	LEACHING PIT NO. 1; LEACHING PIT NO 2; DPDO
		AMMONIUM HYDROXIDE	200 GALS./YR.	LEACHING PIT NO. 1; 1972; LEACHING PIT NO. 2; 1979; NEUTRALIZED TO SANITARY SEWER
		CN SOLUTION	50 GALS./EVERY 6 7 YRS.	1955; LANDFILL NO. 2; 1970

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1980)
PHOTO LAB	451	PHOTOGRAPHIC CHEMICALS (FIXER, DEVELOPER, BLEACH)	3000 GALS./YR.	1953 SANITARY SEWER 1966 SANITARY SEWER/SILVER RECOVERY
STRUCTURAL MAINTENANCE SECTION	451	NAPTHA AND VARSOL	150 GALS./YR.	BURN AREA NO. 1/LANDFILL NO. 2 1970 FPTA NO. 1 1980 DPDO/STEAM PLANT A
EQUIPMENT MAINTENANCE/REPAIR	451	METHYL CHLOROFORM	120 LBS./YR.	LANDFILL NO. 2 DPDO
		WASTE OILS	30 LBS./YR.	BURN AREA NO. 1/FPTA NO. 1 1970 1972 ROADS/FPTA NO. 1 STEAM PLANT A
		WASTE PCB OILS	422 GALS./ONE TIME	1980 DPDO
CENTRAL MACHINE SHOP AND AREA MACHINE SHOPS	451, 640, 690, 760	BLACK DYE	150 GALS./YR.	LEACHING PIT NO. 1 LEACHING PIT NO. 2 DPDO
		NICKEL ACETATE	150 GALS./YR.	LEACHING PIT NO. 1 LEACHING PIT NO. 2 DPDO
		SULFURIC ACID (15% SOLUTION)	150 GALS./YR.	LEACHING PIT NO. 2 DPDO
		NICKEL PENTRATE	125 GALS./YR.	LEACHING PIT NO. 1 LEACHING PIT NO. 2 DPDO
		HYDRAULIC AND LUBRICATING OILS	780 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1 1970 1972 ROADS/FPTA NO. 1 STEAM PLANT A
		COOLANT AND CUTTING OILS	4800 GALS./YR.	BURN AREA NO. 1/FPTA NO. 1 ROADS/FPTA NO. 1 STEAM PLANT A
		ELECTRICAL DISCHARGE OIL	165 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1 ROADS/FPTA NO. 1 STEAM PLANT A
		VACUUM PUMP OIL	55 GALS./YR.	FPTA NO. 1 STEAM PLANT A
		METHYL CHLOROFORM	440 GALS./YR.	1953 LEACHING PIT NO. 2 1980 DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
DISPENSARY	225	PHOTO CHEMICALS AND MISCELLANEOUS CHEMICAL WASTE	200 GALS./YR.	SANITARY SEWER 1953 →
FIRE, POLICE AND COMMUNICATIONS	251	WASTE PCB TRANSFORMER OIL	160 GALS./ONE TIME	DPDO 1980–1984
POWER CONTROL	1525	HARDWARE (PCB CONTAMINATED) TRANSFORMER INSULATION TESTERS	2/ONE TIME	DPDO
		PCB WASTE OILS	39 GALS./ONE TIME	DPDO
		CAPACITORS	3/ONE TIME	DPDO
STEAM PLANT A	1411	WASTE FUEL/WATER MIXTURE	2000 GALS./YR.	ASH PITS 1972 →
		COAL BURNING ASH	NOT DETERMINED	LANDFILL NO. 1 1953–1972
SHIPPING AND RECEIVING WAREHOUSE	1476	WASTE PCB TRANSFORMER OIL	180 GALS./ONE TIME	DPDO 1980–1984
OFFICERS OPEN MESS #1		WASTE PCB TRANSFORMER OIL	490 GALS./ONE TIME	DPDO
OFFICERS OPEN MESS #2		WASTE PCB TRANSFORMER OIL	230 GALS./ONE TIME	DPDO
PRIMARY PUMPING STATION	3038	PCB CONTAMINATED CAPACITORS	6/ONE TIME	DPDO
SECONDARY PUMPING STATION	1507	PCB CONTAMINATED CAPACITORS	15/ONE TIME	DPDO
		WASTE PCB TRANSFORMER OIL	3000 GALS./ONE TIME	DPDO
VISITORS OFFICERS QUARTERS	3027	WASTE PCB TRANSFORMER OIL	200 GALS./ONE TIME	DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTF QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
INSTRUMENT CALIBRATION LAB AND FORCE, FLOW AND DYNAMICS BUILDING	353, 390	METHYL CHLOROFORM	21 GALS./YR.	LANDFILL NO. 2 → DPDO
		ETHYL ALCOHOL	48 LBS./YR.	1965 BURN AREA NO. 1/ FPTA NO. 1 → DPDO
		ACETONE	5 GALS./YR.	FPTA NO. 1 (to 1980)
		MEK	1 GAL./YR.	LANDFILL NO. 2 → DPDO
		ISOPROPYL ALCOHOL	5 GALS./YR.	FPTA NO. 1
		HNO_3 SOLUTION	1 GAL./YR.	SANITARY SEWER
		METHANOL	25 GALS./YR.	FPTA NO. 1 → 1980 DPDO
		WASTE HYDROCARBON FUELS (JP 4)	200 GALS./YR.	1965 CAMP FORREST → STEAM PLANT A. FPTA NO. 2
		HYDROCHLORIC ACID	2 LBS./YR.	SANITARY SEWER

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

------ ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
ENGINE TEST FACILITY				
J 1, J 2 TEST CELLS	880	FREON MF	1500 GALS./YR.	LEACHING PIT NO. 2 — 1960 — CHEMICAL TREATMENT POND — 1980 — DPDO
		WASTE LUBE OIL	350 LBS./YR.	BURN AREA NO. 1/ FPTA NO. 1 — ROADS — STEAM PLANT A FPTA NO. 2
		CUTTING OIL	60 LBS./YR.	1957 — BURN AREA NO. 1 FPTA NO. 1 — ROADS — 1970 1972 — STEAM PLANT A FPTA NO. 2
		PCB WASTE: SMALL CAPACITORS	124/ONE TIME	DPDO 1986 1988
J 3, J 4, J 5 TEST CELLS		ISOPROPANOL (5% SOLUTION CONTAMINATED WITH MMH)	900 GALS./YR.	1966 — BURN AREA NO 1 — 1970 — FPTA NO 1/NO. 2 — DPDO
		FREON MF (5% SOLUTION, FLUSH N_2O_4 SYSTEM)	900 GALS./YR.	CHEMICAL TREATMENT POND — DPDO
		VARSOL	60 GALS./YR.	LANDFILL NO. 1/ BURN AREA NO 1 — 1970 — LANDFILL NO. 2 — DPDO
		WASTE OILS	6 GALS./YR.	FPTA NO. 1
		AEROZINE	VARIABLE *	CHEMICAL TREATMENT POND — 1978
		FIBERGLASS RESIN	NOT AVAILABLE	LANDFILL NO 2 — 1972 — LANDFILL NO. 4 — DPDO
		PCB WASTE OIL	1600 GALS./ONE TIME	DPDO 1980 1984

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

* 1300 LBS. IN 1978

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950–1980)
J 5 TEST CELL	522	WASTE CONTAINERS (O_2, ACETYLENE, FREON, N_2)	NOT AVAILABLE	1966 CAMP FORREST; 1980 LANDFILL NO. 2
		STRONTIUM PERCHLORATE	15 GALS./YR.	CHEMICAL TREATMENT POND; 198[illegible] DPDO
		TCE	24 LBS./YR.	LANDFILL NO. 2; 1980 DPDO
		FREON (CHANNEL MASTER SPRAY)	300 LBS./YR.	LEACHING PIT NO. 2; DPDO
AIR COMPRESSOR AND TEST BUILDING (T 1 THROUGH T 5)	878	WASTE OIL	24 GALS./YR.	1951 FPTA NO. 1; 1973 FPTA NO. [illegible]; 1980
		TRICHLOROETHYLENE	400 GALS./YR.	LANDFILL NO. 2 LEACHING PIT NO. 2; DPDO
		WASTE OIL & HYDROCARBON FUELS	1000 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1; 197[illegible] FPTA NO. [illegible] STEAM PLANT A
		SULFURIC ACID (4% SOLUTION)	350 LBS./YR.	SANITARY SEWER
		ETHYLENE GLYCOL	600 GALS./YR.	LEACHING PIT NO. 2; 1980 DPDO
		VARSOL	2400 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1; 1973 FPTA NO. 2; 1980 DPDO
		FREON MF/TF, ALCOHOL, OIL, FUEL MIXTURES	155 GALS./YR.	FPTA NO. 1; FPTA NO. 2 STEAM PLANT A
		JP FUELS	120 GALS./YR.	FPTA NO. 1; FPTA NO. 2 STEAM PLANT A
		ETHYL ALCOHOL	300 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1; FPTA NO. 2; 1980 DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
AIR COMPRESSOR AND TEST BUILDING (T 1 THROUGH T 5) (CONT'D)	878	PCB CONTAMINATED WASTE		
		LARGE CAPACITORS	39/ONE TIME	1980 DPDO
		SMALL CAPACITORS	224/ONE TIME	DPDO
		WASTE OIL	40 GALS./ONE TIME	DPDO
		TRANSFORMER	1/ONE TIME	DPDO 1984
		BERYLLIUM WASTE	NOT AVAILABLE	LANDFILL NO. 2; DPDO
EXHAUSTER BUILDING	882	WASTE FREON	150 GALS./YR.	1956 LEACHING PIT NO. 2; DPDO
		WASTE OIL	150 GALS./ONE TIME	DPDO 1982 1983
		PCB CONTAMINATED WASTE		
		WASTE OIL	1100 GALS./ONE TIME	DPDO
		CAPACITORS	33 GALS./ONE TIME	DPDO
J 3 TEST CELL		PCB WASTE TRANSFORMER OIL	5000 GALS./ONE TIME	DPDO 1980 1984
VON KARMAN FACILITY				
G RANGE	678	PHOTOGRAPHY CHEMICALS	100 LBS./YR.	1961 SANITARY SEWER
		METHYL CHLOROFORM	250 GALS./YR.	LEACHING PIT NO. 2 LANDFILL NO. 2; DPDO
		WASTE OIL	360 LBS./YR.	BURN AREA NO. 1 FPTA NO. 1; STEAM PLANT A
		PRIMERS	360 LBS./YR.	CAMP FORREST; 1980 DPDO
		WASTE GUNPOWDER	1.2 LBS./YR.	CAMP FORREST; DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL 1950 1960 1970 1980
G RANGE (CONT'D)	678	BERYLLIUM WASTE	3 DRUMS/YR.	LANDFILL NO. 2 → 1980 DPDO
		DEPLETED URANIUM	13 DRUMS/YR.	LANDFILL NO. 2 → OFF SITE CONTRACT DISPOSAL
		LEAD CHIPS	150 LBS./YR.	LANDFILL NO. 1 → COMMERCIAL SALE
		ACETONE	100 LBS./YR.	FPTA NO. 1 → FPTA NO. 2
		TCE DEVELOPER	180 LBS./YR.	LANDFILL NO. 2/ SANITARY SEWER → DPDO
		ETCHING FLUID (FERRIC CHLORIDE)	180 LBS./YR.	LEACHING PIT NO. 2 SANITARY SEWER → 1980 DPDO
		PCB CONTAMINATED WASTE		
		LARGE CAPACITORS	750/ONE TIME	DPDO 1980 1984
		SMALL CAPACITORS	4/ONE TIME	DPDO
		SCRAP HARDWARE	3 DRUMS/ONE TIME	DPDO
		TRANSFORMER OIL	13000 GALS./ONE TIME	DPDO
S RANGE	320	METHYL CHLOROFORM	5 GALS./YR.	1964 LANDFILL NO. 2 → DPDO
K RANGE	675	DEPLETED URANIUM	0.5 DRUMS/YR.	1958 LANDFILL NO. 2 → OFF SITE CONTRACT DISPOSAL
		METHYL CHLOROFORM	5 GALS./YR.	LANDFILL NO. 2 → DPDO

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950–1980)
MAIN TEST & LAB BUILDING	676	PHOTOGRAPHIC CHEMICALS	600 700 LBS./YR.	1954 SANITARY SEWER → SANITARY SEWER/SILVER RECOVERY
		TCE DEVELOPER	6 GALS./YR.	LEACHING PIT NO. 2 → DPDO
		FERRIC CHLORIDE ETCHER	36 GALS./YR.	LEACHING PIT NO. 2/RETENTION RESERVOIR → DPDO
		CONTAMINATED ISOPROPYL ALCOHOL	80 GALS./YR.	FPTA NO. 1 → 1980 DPDO
		MISCELLANEOUS ACIDS	NOT DETERMINED	SANITARY SEWER
		VARSOL	60 GALS./YR.	BURN AREA NO. 1 → 1956 LANDFILL NO. 2 → DPDO
APTU	579	ISOPROPYL ALCOHOL	150 GALS./YR.	1972 CAMP FORREST → DPDO
		FREON MF	200 GALS./YR.	CAMP FORREST → DPDO
		TOLUENE	100 GALS./YR.	CAMP FORREST → DPDO
		PRIME WATER MIXTURE	350 GALS./YR.	SANITARY SEWER
		PCB WASTE OIL	200 GALS./ONE TIME	1980 DPDO 1984
VKF YARD AREA	676	WASTE OILS	1000 GALS./YR.	FPTA NO. 1 → 1970 ROADS/FPTA NO. 1 → 1972 STEAM PLANT A
		FREON TF	55 GALS./YR.	LEACHING PIT NO. 2 → DPDO
		FREON MF	55 GALS./YR.	1959 LEACHING PIT NO. 2 → DPDO
		PCB CONTAMINATED LARGE CAPACITORS	18/ONE TIME	1980 DPDO 1984

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
MARK I	1075	ISOPROPYL ALCOHOL	300 GALS./YR.	1965 BURN PIT NO. FPTA NO. 2 — 1973 — FPTA NO. 1/ STEAM PLANT A 1980
		FREON MF	55 GALS./YR.	LEACHING PIT NO. 2 — DPDO
		FREON TF	55 GALS./YR.	LEACHING PIT NO. 2 — DPDO
		METHYL CHLOROFORM	55 GALS./YR.	LEACHING PIT NO. 2 — DPDO
		KEROSENE	55 GALS./YR.	BURN AREA NO. 1 — 1970 FPTA NO. 1 — 1973 FPTA NO. 2 — 1980
		PERCHLOROETHYLENE	110 GALS./YR.	CAMP FORREST — DPDO
		WASTE OIL	450 GALS./YR.	ROADS, BURN AREA NO. 1 — FPTA NO. 1 — 1970 — FPTA NO. 2; STEAM PLANT A
ENGINEERING LAB (ELECTRONIC MAINTENANCE)	1077	TCE DEVELOPER	24 LBS./YR.	LANDFILL NO. 2 — DPDO
		ETCHING SOLUTION (FERRIC CHLORIDE)	5 LBS./YR.	1964 LEACHING PIT NO. 2 — 1980 DPDO
TUNNEL F	690	BERYLLIUM WASTE	SMALL AMOUNTS	1960 LANDFILL NO. 2 — DPDO
		ACETONE	24 GALS./YR.	FPTA NO. 1 — 1973 — FPTA NO. 2
		KETONE	24 GALS./YR.	LEACHING PIT NO. 2 — DPDO
		METHYL CHLOROFORM	240 GALS./YR.	LEACHING PIT NO. 2 — DPDO
		NaK	12 GALS./YR.	CAMP FORREST — DPDO
		PCB WASTE OIL AND SOLVENTS	6000 GALS./ONE TIME	DPDO 1980 – 1984

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950–1980)
VKF DRIER BUILDING	784	WASTE PCB OIL	160 GALS./ONE TIME	1980 DPDO 1984
MAIN COMPRESSOR BUILDING		WASTE OIL	300 GALS./YR.	1954 FPTA NO. 1 → STEAM PLANT A
		FREON TF	55 GALS./YR.	LEACHING PIT NO. 2 - - → DPDO
		FREON MF	55 GALS./YR.	LEACHING PIT NO. 2 - - → 1980 DPDO
PROPULSION WIND TUNNEL				
MODEL INSTALLATIONS BUILDING	760	ACETONE	11 GALS./YR.	1954 FPTA NO. 1 → 1973 FPTA NO. 1, NO. 2
		1,1,1, TRICHLOROETHANE	300 GALS./YR.	LEACHING PIT NO. 2 - - → 1980 DPDO
		METHYL CHLOROFORM	450 GALS./YR.	LEACHING PIT NO. 2 - - → DPDO
		ISOPROPYL ALCOHOL	75 GALS./YR.	BURN AREA NO. 1/ FPTA NO. 1 → 1970 FPTA NO. 1
		WASTE OIL	600 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1 → ROADS FPTA NO. 1 → STEAM PLANT A
		PCB CONTAMINATED WASTE		
		SOLID	15 DRUMS/ONE TIME	DPDO
		LIQUID	700 GALS./ONE TIME	1980 DPDO 1984
16 S and 16 T TUNNEL SYSTEMS		METHYL CHLOROFORM	300 GALS./YR.	1955 LEACHING PIT NO. 2 - - → DPDO
		WASTE OILS	1500 GALS./YR.	BURN AREA NO. 1 FPTA NO. 1 → 1970 ROADS FPTA NO. 1 → FPTA NO. 2 STEAM PLANT A

KEY

——— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 – 1960 – 1970 – 1980)
		VARSOL	100 GALS./YR.	LANDFILL NO. 1 → LANDFILL NO. 2 → DPDO
		WASTE ASBESTOS	3 DRUMS/YR.	LANDFILL NO. 1 → 1956 LANDFILL NO. 2 - - - 1984
		PCB WASTE OIL	7000 LBS/ONE TIME	1980 DPDO
16 S CONTROL BUILDING	745	WASTE OIL	50 GALS./YR.	1958 FPTA NO. 1 → 1970 STEAM PLANT/ROADS/FPTA NO. 2
		NAPTHA	3 GALS./YR.	LANDFILL NO. 2/SANITARY SEWER
16 T CONTROL BUILDING (PHOTO LAB)	785	PHOTOGRAPHIC CHEMICALS	40 GALS./YR.	1955 SANITARY SEWER
		TRICHLOROETHYLENE	1 GAL./YR.	LEACHING PIT NO. 2 → 1956 LANDFILL NO. 2 → 1980 DPDO
P PLANT	620	SULFURIC ACID	15000 GALS./YR.	1963 NEUTRALIZED TO SANITARY SEWER
		CAUSTIC	25000 GALS./YR.	NEUTRALIZED TO SANITARY SEWER
		TRICHLOROETHYLENE	100 GALS./YR.	LEACHING PIT NO. 2 - - - 1980 DPDO
MOTOR DRIVE BUILDING	780	METHYL CHLOROFORM	1300 GALS./YR.	1953 LEACHING PIT NO. 2 - - - DPDO
		WASTE OILS	3500 GALS./YR.	BURN AREA NO. 1 → 1970 ROADS FPTA NO. 2 → FPTA NO. 2 STEAM PLANT A
		KEROSENE	150 GALS./YR.	FPTA NO. 1 → 1971 FPTA NO. 2/STEAM PLANT A
		PCB WASTE TRANSFORMER OIL	2500 GALS./ONE TIME	DPDO
		CAPACITORS	12/ONE TIME	1980 DPDO 1984

KEY

———— CONFIRMED TIME FRAME DATA BY SHOP PERSONNEL

- - - - - - ESTIMATED TIME FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

TABLE 4.1 (cont'd)

INDUSTRIAL OPERATIONS (Shops)

Waste Management

SHOP NAME	LOCATION (BLDG. NO.)	WASTE MATERIAL	WASTE QUANTITY	METHOD(S) OF TREATMENT, STORAGE & DISPOSAL (1950 1960 1970 1980)
PLENUM EVACUATION SYSTEM (PES)	710	LUBE OILS	360 LBS./YR.	1958 ROADS/FPTA NO. 1/BURN AREA NO. 1; FPTA NO. 2/STEAM PLANT A
		WASTE OILS	1500 LBS./YR.	ROADS/FPTA NO. 1/BURN AREA NO. 1; 1970 1972 FPTA NO. 2/STEAM PLANT A
		RAGS WITH WASTE OILS	120 LBS./YR.	LANDFILL NO. 2; 1971 LANDFILL NO. 4
		DIESEL FUELS	120 LBS./YR.	BURN AREA NO. 1/FPTA NO. 1; 1973 FPTA NO. 2/STEAM PLANT A
		FILTERS WITH LUBE OIL	200 LBS./MO.	FPTA NO. 1/LANDFILL NO. 1; 1971 FPTA NO. 2/LANDFILL NO. 4
		CONTAMINATED TCE DEVELOPER	3 GALS./YR.	LEACHING PIT NO. 2/LANDFILL NO. 2; 1980 DPDO
		CONTAMINATED ETCHER	3 GALS./YR.	1958 LEACHING PIT NO. 2; DPDO
		PCB WASTE CAPACITORS	36/ONE TIME	1980 1984 DPDO
		TRANSFORMER OIL	2000 GALS./ONE TIME	DPDO
HIGH TEMPERATURE LAB	722	METHANOL	60 LBS./YR.	FPTA NO. 1; 1970 FPTA NO. 2
		METHYL CHLOROFORM	60 LBS./YR.	LEACHING PIT NO. 2; 1980 DPDO
		KOH/METHANOL MIX	24 LBS./YR.	1966 SANITARY SEWER; DPDO
		PCB WASTE CAPACITORS	3/ONE TIME	1984 DPDO
		TRANSFORMER OIL	15000 GALS./ONE TIME	DPDO

KEY

——— CONFIRMED TIME-FRAME DATA BY SHOP PERSONNEL

- - - - - ESTIMATED TIME-FRAME DATA BY SHOP PERSONNEL

NOTE: WASTE QUANTITIES SHOWN ARE CURRENT VALUES

the Fire Protection Training Area (FPTA), and the old Camp Forrest Water Treatment Plant site. Wastes disposed at the Camp Forrest Water Treatment Plant in the 1950's and later years have generally been highly reactive propellants. The Model Shop leaching pit primarily received acid solutions. Waste oils, fuels and solvents were the primary materials burned at the "fire pit" at the FPTA. During this period the area just east of the existing Retention Reservoir started to be used as an area for disposal of a wide variety of industrial wastes. Some were buried in this area and others leached to the ground. The testing areas were subject to routine spills and leaks in the 1950's and later years. Spills to the Rollins Creek drainage system in the 1950's were uncontrolled since the Retention Reservoir had not been constructed.

From 1959-1961, the Retention Reservoir and Chemical Treatment Pond were constructed to assist in control of hazardous wastes reaching the Rollins Creek cooling water return ditch. The Retention Reservoir since the 1960's has enabled capture and treatment of wastes due to the holding time in the impoundment. The Chemical Treatment Pond has served as a facility to batch-treat small quantities of wastes, primarily propellants. During the 1960's the landfill/burning area (near Gate 5), Model Shop leaching pit, Camp Forrest Water Treatment Plant, FPTA, and landfill/leaching area east of the Retention Reservoir continued to receive shop wastes. Also, three other small areas west and south of the Retention Reservoir were used as leaching and/or burning sites for small volume special wastes.

In the early 1970's open burning and disposal operations at the landfill near Gate 5 ceased, and the landfill east of the Retention Reservoir was expanded to handle normal nonhazardous wastes as well as the contaminated type which had previously been exclusive to this site. Another FPTA was constructed at the old Gate 5 landfill site, and some combustible shop wastes were burned at this location. The Steam Plant also began burning waste oils in the early 1970's. Shop wastes continued to be taken to the Camp Forrest Water Treatment Plant and treated at the Chemical Treatment Pond and Retention Reservoir. The small leaching/burning areas west and south of the Retention Reservoir no longer functioned in the 1970's. The leaching pit at the Model Shop was closed down and replaced with neutralization tanks, and the pit near the

Retention Reservoir was closed in the late 1970's. Spills and leaks in the testing and other industrial areas are believed to have become less frequent in the 1970's.

During the mid 1970's and early 1980's, shop wastes were more frequently taken to off-base disposal locations. Disposal of hazardous wastes at Camp Forrest, the FPTA's, the landfill/leaching pit east of the Retention Reservoir, and the Chemical Treatment Pond ceased in the early 1980's.

AEDC has used polychlorinated biphenyls (PCB) and chlorinated hydrocarbon oils in many capacitor and transformer fluids and in some hydraulic fluids. In 1980, AEDC implemented a plan of sampling/analysis which involved monitoring potable, recreational and waste water, fish, soil, sediment, and landfill monitoring wells. Also in that year, the Air Force presented a compliance plan to the EPA which contained a list of projects for the elimination of PCB's and associated equipment from AEDC. Table 4.1 includes a list of PCB waste sources, locations, and quantities.

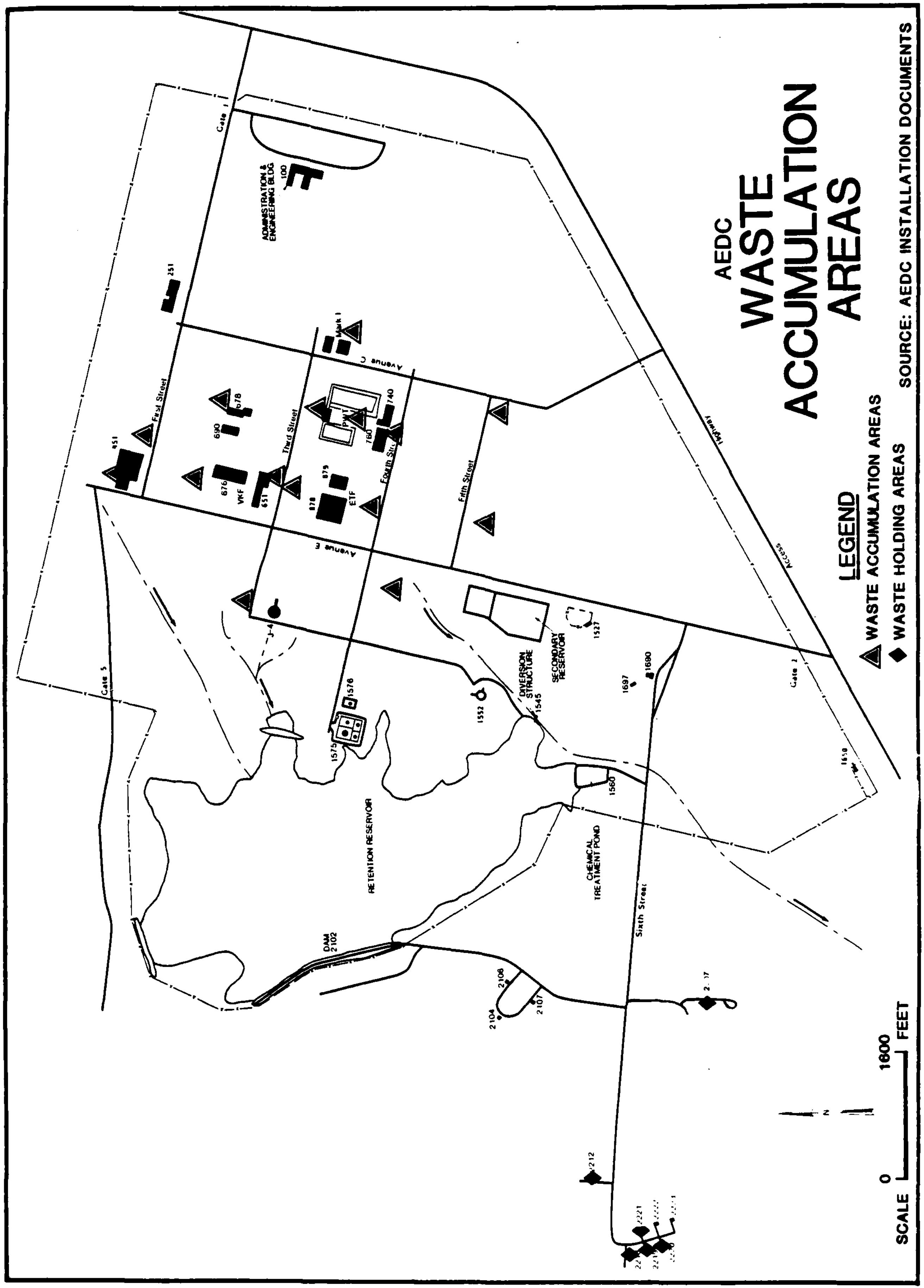
Waste Accumulation and Storage Areas

Hazardous waste containers are stored in Buildings 2207, 2212, 2218, 2219, 2220 and 2221. The locations of these buildings can be found in Figure 4.1.

Building 2212 is the largest holding area with a total floor space of 3504 square feet. This facility at one time was used to store flammable fuels but was modified to meet the requirements for PCB storage in 1980. The modifications included sealing the floor and floor drains, discontinuing use of the sump, and installing a 9-inch curb. In addition, the building rests on an 8-inch concrete slab. It has a maximum storage capacity of 1296 drums or 71,280 gallons. In the period 1980 to present a large number of PCB drums have been stored at this location. No spills or leaks have occurred at this site.

Buildings 2218, 2219, 2220 and 2221 have been used to store hazardous liquids since about 1980. All buildings are of identical design with the exception of 2218 which is larger. Reinforced concrete walls 8 inches thick surround three sides of the structure in addition to an earth embankment. The fourth side is open and has sloping wing walls extending out each side. Each has a concrete sump (4,290 gallons)

FIGURE 4.1


AEDC
WASTE ACCUMULATION AREAS
SOURCE: AEDC INSTALLATION DOCUMENTS
LEGEND
WASTE ACCUMULATION AREAS
WASTE HOLDING AREAS
SCALE
0
1600
FEET
ADMINISTRATION & ENGINEERING BLDG
100
251
451
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Gate 1
Gate 2
Gate 5
Highway
Access
Mark I
676
VKF
651
690
678
878
879
ETF
PWT
740
760
1575
1576
1552
DIVERSION STRUCTURE
1545
SECONDARY RESERVOIR
1527
1697
1680
1560
RETENTION RESERVOIR
CHEMICAL TREATMENT POND
DAM
2102
2104
2106
2107
2212

containing limestone that is the secondary containment system for any spills or leaks. The maximum storage capacity of Building 2218 is 52 drums or 2,860 gallons, and Buildings 2219, 2220 and 2221 have a maximum storage capacity of 72 drums or 3,960 gallons.

Building 2207 is used to store solid explosive waste. The materials stored consist of waste propellants, smoke grenades and primers. Three steel shipping containers which are placed side by side are provided. The building is covered on the top and three sides by sand bags and an earth enbankment.

Various precautions besides the above mentioned are used to prevent hazards from the waste being handled. For example, the drums are stored on pallets to elevate them from contact with standing liquids. Drums are segregated from building to building to ensure compatability of waste.

Before being transferred to these storage areas, wastes are kept in staging areas which are called "accumulation points." There are currently 15 accumulation point areas at AEDC, and the locations are shown in Figure 4.1. A listing of the accumulation points is included in Table 4.2. The wastes are held at these areas for less than 90 days before being taken to the waste holding areas. The wastes are then periodically picked up, transported and disposed off site by the Defense Property Disposal Office (DPDO).

There have not been any spills or leaks in the waste holding areas since they have been used for this purpose. The containment structures built into these facilities allow efficient cleanup of any small leaks or spills which may occur.

In the past, before specific accumulation points were designated, waste was held in areas near shops or test cells and picked up on a regular basis and taken to its disposal site. Currently, Fuels Management handles most waste pickup. In the past, the Fire Department and Roads and Grounds have had responsibility for waste collection and disposal. The Fire Department handled the explosive and reactive wastes.

Fuels Management

The type of operations and testing which is performed at AEDC calls for large quantities and a great variety of fuels and propellants.

TABLE 4.2
WASTE ACCUMULATION POINTS

J-4 Area	Building No. 521
ETF Hardstand	Building No. 878
ETF J1 and J2	Building No. 880
VKF Drier Control	Building No. 670
VFK Hot Shot	Building No. 675
PWT 16S Control	Building No. 745
PWT Model Installation	Building No. 760
PWT Motor Drive	Building No. 780
Mark I Test	Building No. 1075
Chem Lab	Building No. 445
Fabrication & Maintenance Shop	Building No. 451
Machine Shop	Building No. 640
Auto Repair Shop	Building No. 1400
Paint Shop and Buildings & Grounds	Building No. 1478
Power Control	Building No. 1525

Source: AEDC documents.

Table 4.3 contains a list of the fuel storage tanks presently in use including capacity, type and location. There are two main fuel farms, the Bulk Fuel Farm and the Test Fuel Farm, which can be seen in Figure 4.2. In the Test Fuel Farm and in the ETF area, there are tanks which are designated for commingled fuel, which is a mixture of fuels remaining after testing procedures have been completed and also contaminated fuels not used in testing. This waste is utilized by the Steam Generating Plant A as a fuel in the production of steam. As shown in Table 4.3 there are a number of tanks which are used to store fuels which are used by emergency generators.

Table 4.4 contains a listing of semitrailer fuel tanks used at AEDC. These are used to carry a variety of fuels and propellants to various test locations. In addition, they are used to transport solvents and oils which may be used in large quantities in various areas of the Center. Table 4.5 contains a list of the abandoned tanks which were once actively used at AEDC. Missile propellants are used in many testing procedures performed at AEDC. A listing of the current inventory of missile propellant tanks is shown in Table 4.6.

The majority of fuel transfer takes place through pipelines which prevent contact and minimizes the risk involved in handling these fuels. When needed, semitrailers are used to transport fuels, propellants, and oils. Semitrailers are used because they are a convenient method of transporting these materials to various areas of the Center.

The tanks are monitored daily using inspection sheets which record information on types and quantities of fuels in the tanks. The tanks are inspected for cleaning needs every three years. There have been some spills and leaks related to fuel system equipment failures. These spills and leaks are discussed later in this section. The fuel lines are inspected yearly through pressure checks. When cleaning is required, Fuels Management handles the disposal of the sludge. Sludge has usually been burned at Fire Protection Training Areas.

Spills and Leaks

Spills and leaks from industrial operations at AEDC, particularly the VKF, ETF and PWT areas, have been fairly routine but usually not large. Records for spills have been kept only over the past three years; however, water quality monitoring of Rollins, Bradley and

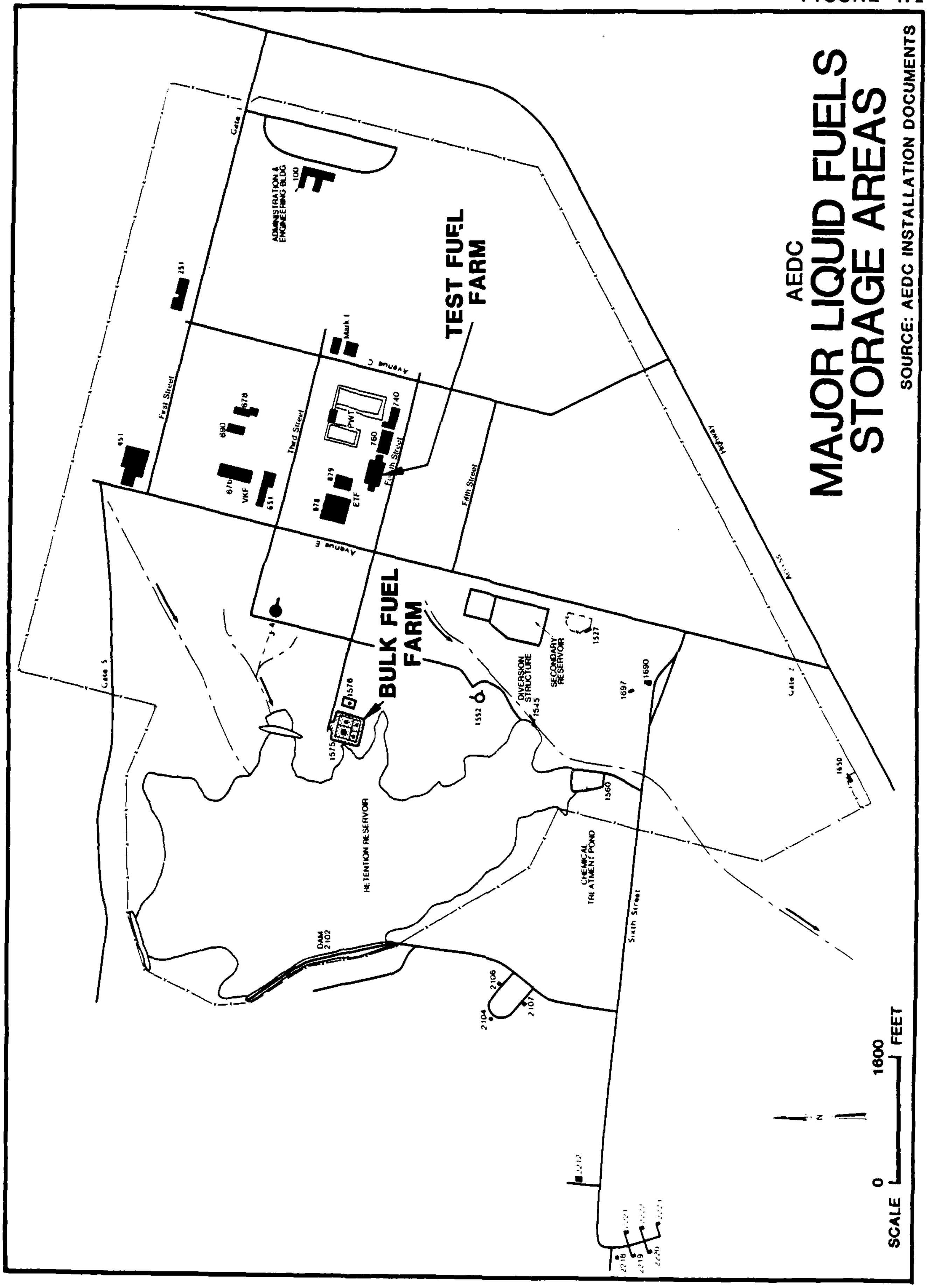
TABLE 4.3
FUEL STORAGE TANKS

Type of Material	Capacity Each Tank (gallons)	Type of Storage Facility	Location of Storage Facility
Fuel Storage Farms			
JP-4 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 5
JP-4 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 6
JP-4 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 8
JP-4 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 9
JP-4 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 11
JP-8 Fuel	1-40,000	Diked Tank	Test Fuel Farm Tank No. 7
JP-5 Fuel	1-25,000	Diked Tank	Test Fuel Farm Tank No. 4
Commingled Fuel	1-10,000	Diked Tank	Test Fuel Farm Tank No. 13
Commingled Fuel	1-4,200	Underground Tank	Test Fuel Farm Tank No. 14
Commingled Fuel	1-4,200	Underground Tank	Test Fuel Farm Tank No. 15
Commingled Fuel	1-4,200	Underground Tank	Test Fuel Farm Tank No. 16
JP-4 Fuel	3-210,000	Diked Tank	Bulk Fuel Farm
FS-2 Fuel	1-420,000	Diked Tank	Bulk Fuel Farm
JP-4 Fuel	1-630,000	Diked Tank	Bulk Fuel Farm
Vehicle/Equipment Fuel			
Gasoline, Leaded	1-15,000	Underground Fiberglass Tank	Auto Maintenance Shop Area
Gasoline, Unleaded	1-15,000	Underground Fiberglass Tank	Auto Maintenance Shop Area
Diesel Fuel	1-15,000	Underground Fiberglass Tank	Auto Maintenance Shop Area
Diesel Fuel	1-5,000	Underground Tank	Automative Shop

TABLE 4.3 (Continued)
FUEL STORAGE TANKS

Type of Material	Capacity Each Tank (gallons)	Type of Storage Facility	Location of Storage Facility
Fuel			
Fuel Oil	1-210,000	Diked Tank	Steam Plant A
Fuel Oil	1-30,000	Diked Tank	Steam Plant B
Diesel Fuel	2-300	Underground Tank	Steam Plant A
Fuel Oil	2-5000	Diked Tank	Steam Plant B
Fuel Oil	1-25,000	Underground Tank	ETF Heaters
Fuel Oil	1-18,000	Underground Tank	ETF Heaters
Fuel Oil	1-18,000	Underground Tank	ETF Heaters
Diesel Fuel	1-500	In Dam Structure Emergency Gen. Power	Elk River Dam
Diesel Fuel	1-1100	Underground Tank Emergency Pump Power	Primary Pumping Station
Diesel Fuel	1-250	Above Ground Tank Emergency Gen. Power	VKF
Diesel Fuel	1-250	Above Ground Tank Emergency Gen. Power	ETF
Diesel Fuel	1-200	Above Ground Tank Emergency Gen. Power	PWT PES Control Building
Diesel Fuel	1-250	Above Ground Tank Emergency Gen. Power	PWT Motor Drive Building
Diesel Fuel	1-275	Underground Tank Emergency Gen. Power	Arnold Airfield
Gasoline	1-550	Underground Fiberglass Tank, Emergency Pump Power	Water Treatment Plant
Diesel Fuel	1-500	Underground Tank, Emergency Gen. Power	Sewage Treatment Plant
Gasoline	1-1,000	Underground Tank	Officers Club Boat Dock
Commingled Fuel	1-2,000	Underground Tank	ETF "B" Plant
Commingled Fuel	1-2,000	Underground Tank	ETF "A" Plant
Commingled Fuel	1-5,000	Underground Tank	ASTF - Fuel Storage Bldg.
Glycol	1-10,000	Underground Tank	ASTF - RC-1 Cooler
Waste Oil	1-150	Underground Tank	Mark I Hardstand

Source: AEDC documents.



AEDC
MAJOR LIQUID FUELS STORAGE AREAS
SOURCE: AEDC INSTALLATION DOCUMENTS

TABLE 4.4
SEMITRAILER FUEL TANKS

Type of Material	Capacity Each Tank (gallons)	Type of Storage Facility	Location of Storage Facility
Transformer Oil	2-10,000	Semitrailer	Flammable Yard
Transformer Oil	1-4,000	Semitrailer	ETF-Underground Main Elec. Substation
Varsol	1-4,000	Semitrailer	Flammable Yard
Kerosene	1-3,800	Semitrailer	Flammable Yard
Propane	1-2,500	Semitrailer	ETF "A" Air Side
Fuel	2-3,800	Semitrailer	-
Fuel	3-4,000	Semitrailer	-
Fuel	2-5,000	Semitrailer	-
UDMH	1-4,000	Semitrailer	-
N_2O_4	1-2,250	Semitrailer	-
Compressed Gas	26-55,000 ft^3	Semitrailer	N_2O_4 Transfer Pad
Cylinder	@ 2,000 psi		
LO_2 & LN_2	4-1,800	Semitrailer	-
	8-4,000		
Tank Refueler	2-5,000	Semitrailer	-

Source: AEDC documents.

TABLE 4.5
ABANDONED TANKS

Type of Material	Capacity East Tank (gallons)	Type of Storage Facility	Location of Storage Facility
Gasoline	1-5,000	Underground Steel	Auto Repair Shop
	1-5,000	Underground Steel	Auto Repair Shop
Diesel Fuel	1-5,000	Underground Steel	Auto Repair Shop
Diesel Fuel	2-5,000	Undernround	Steam Plant "A"
Gasoline	1-250	Underground	Water Treatment Plant
Diesel Fuel	1-250	Underground	Primary Pumping Station

Source: AEDC documents.

TABLE 4.6
MISSILE PROPELLANT STORAGE TANKS

Type of Material	No. of Tanks	Rated Capacity	Location
Helium (He)	3	370,000 cu. ft.	Cen. Plant
	40	98,000 cu. ft.	Mark I
	3	107,000 cu. ft.	J-4
	1	14,000 cu. ft.	J-3
	10	654,000 cu. ft.	J-4
	2	9,000 cu. ft.	ETF/O
	24	152,000 cu. ft.	J-3
Liquid Nitrogen (LN_2)	1	95 ton	Cen. Nitrogen
	1	95 ton	J-1
	1	44 ton	ELA
	7	508 ton	J-4
	5	468 ton	PWT
	1	54 ton	Mark I
	1	45 ton	VKF-L
	1	95 ton	J-3
Liquid Oxygen (LO_2)	1	134 ton	J-1
	1	95 ton	J-4
	2	5 ton	R2C
Nitrogen Tetroxide (N_2O_4)	2	65,000 lb	J-3
	1	3,000 lb	R2B
	2	10,000 lb	T-4
	2	4,000 lb	J-5
	1	44,000 lb	J-4
	1	18,000 lb	J-2
	1	12,000 lb	J-2A
Hydrazine (N_2H_4)	1	600 lb	R2B
	2	99,000 lb	J-4
	2	18,500 lb	J2A
	2	43,000 lb	J-3
	3	16,000 lb	T-4
Liquid Hydrogen (LH)	1	5,000 lb	PWT
	4	66,500 lb	J-4

Source: AEDC documents.

Brumalow Creeks indicates spills have occurred during most of the installation's history. Most of the spills and leaks have been small in volume. From 1982 to 1984 approximately 50 spills and leaks have been noted; nearly all are under 500 gallons and most are less than 100 gallons. Materials lost primarily include hydraulic and lubricating oils. Figure 4.3 shows the primary spill and leak areas.

In April of 1984 a pipe leak occurred in the ETF area with loss of approximately 1400 gallons of JP-4 fuel. Some fuel drained to a barometric well and then to Rollins Creek/Retention Reservoir, but most went into the ground. Investigation of this leak was in progress during the on-site visit for this study.

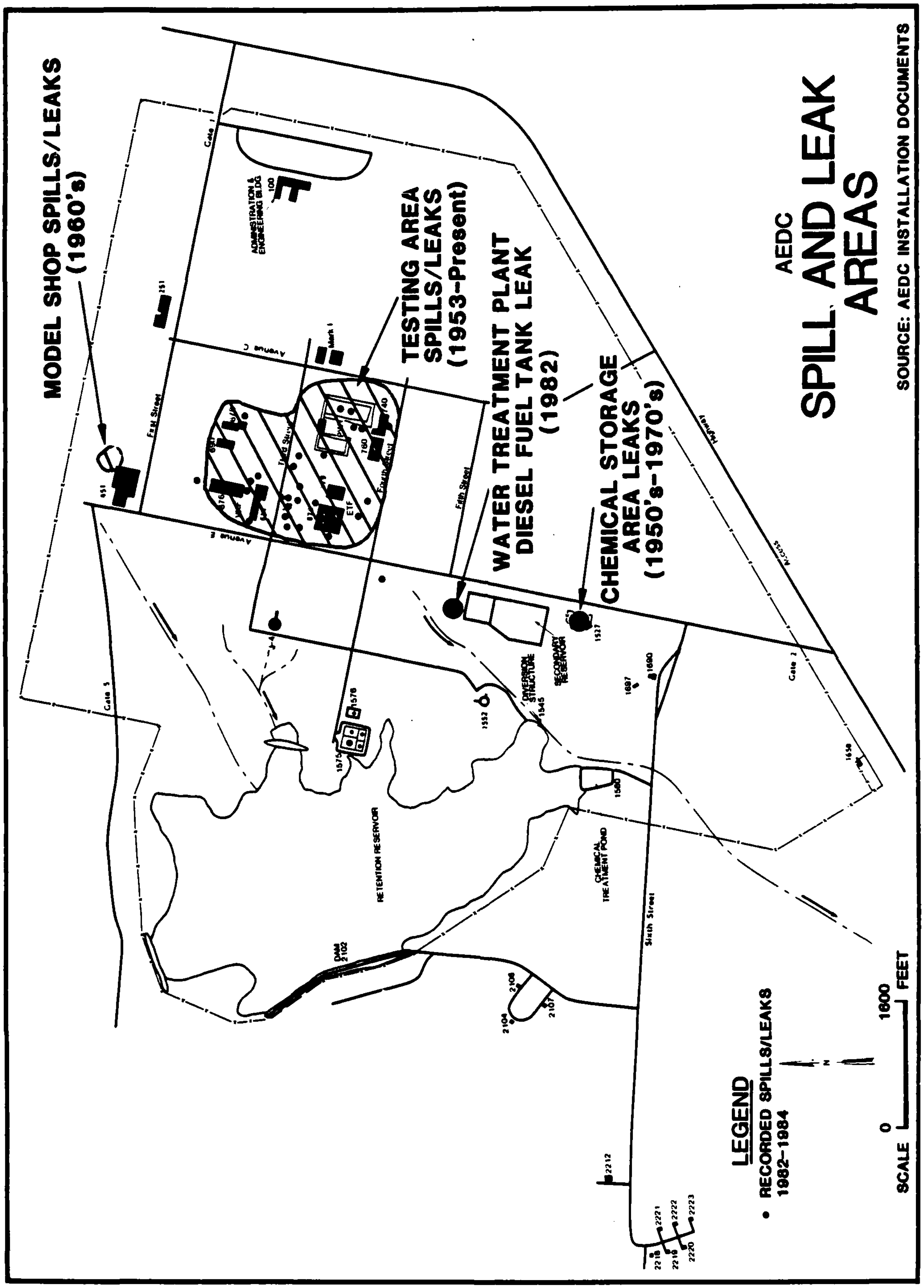
Since AEDC has been operating, approximately two to three major acid spills/leaks have occurred at the Model Shop leaching pit area. These involved losses of about 2000 gallons of nitric and/or hydrochloric acids each time to Ditch H, a tributary to Bradley Creek. These spills/leaks predominatly occurred in the 1960's.

Leaks of 55 gallon drums have been indicated in the Paint, Gas and Chemical Storage Area (1530). Prior to 1958 a drum of white nitric acid leaked, and in the mid-1960's a DDT leak occurred. A freon drum leaked in the mid 1970's. The DDT and nitric acid losses were washed to the ground and the surface drainage system by the Fire Department. Most of the freon had evaporated upon discovery of the leak.

In the late 1970's, a large spill of FS-2 fuel occurred in the test fuel farm. Approximately 10,000 gallons of fuel spilled but was contained in the dike structure. Cleanup resulted in the recovery of all but about 600 gallons of fuel. About 50 gallons of fuel later surfaced from the ground outside the dike structure and was removed.

Less than three years ago, on the west end of the test fuel farm, a leak occurred on the commingled fuel line. The composition of the fuel was believed to about 90 percent JP-4 and the amount of fuel lost was not determined. The area surrounding the leak was excavated and removed and the fuel line repaired. Uncontaminated soil was used to replace that which was removed.

An accident occurred on November 17, 1982, in which a significant amount of Class 1.3 solid rocket propellant was dropped to the bottom of Cell J-4 at AEDC from an MX Stage II test motor. The propellant was


AEDC
SPILL AND LEAK AREAS
SOURCE: AEDC INSTALLATION DOCUMENTS
MODEL SHOP SPILLS/LEAKS (1960's)
TESTING AREA SPILLS/LEAKS (1953-Present)
WATER TREATMENT PLANT DIESEL FUEL TANK LEAK (1982)
CHEMICAL STORAGE AREA LEAKS (1950's-1970's)
ADMINISTRATION & ENGINEERING BLDG
RETENTION RESERVOIR
CHEMICAL TREATMENT POND
SECONDARY RESERVOIR
DIVERSION STRUCTURE
DAM 2102
First Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Gate 1
Gate 2
Gate 3
Access Highway
ETF
LEGEND
• RECORDED SPILLS/LEAKS 1982-1984
SCALE 0 1600 FEET

removed from the Test Cell. The propellant was burned in 1983 near the airfield at Burn Area No. 2 by the Explosive Ordinance Disposal Team (EOD) from Patrick AFB. A further discussion of the burn area is included later.

In 1982 a 250-gallon gasoline fuel tank at the water treatment plant was determined to be leaking and was replaced with a 550-gallon tank. No physical evidence of the leak was apparent at the site and the leak was apparently discovered through inventory records or tank testing.

Pesticide Utilization

A variety of pesticides have been used at AEDC since 1952 for controlling weeds, insects and rodents. Appendix D contains a listing of the pesticides which are currently approved for use at AEDC. In 1974 an environmental assessment of the pesticide program at AEDC was conducted, and the procedures were deemed satisfactory. Appendix D contains a list of pesticides in use in 1974.

Since 1982 some pesticides have been stored and mixed in Building 1414. Containers are rinsed with rinsewater going to the sanitary sewer and the empty containers are taken to a special dumpster which is then transported to Landfill No. 2 for disposal. Prior to 1982 pesticides were mixed in the Nursery Area (just north of the Wastewater Treatment Plant adjacent to the road entering Landfill No. 2). Unrinsed containers were buried at the nearby Landfill No. 2.

The sprayers used for applying pesticides at AEDC have not normally been rinsed but are operated until all solutions have been sprayed out.

In addition to the pesticide mixing and application described above, there have been several outside contractors utilized for applying pesticides. These contractors do all the mixing and handling of empty containers off the installation grounds.

The Tennessee Valley Authority (TVA) power transmission corridors entering the AEDC have received herbicide applications by TVA. Appendix D lists the probable chemicals used for this purpose. No herbicides have been applied to the electrical corridors for about ten years. Prior to that, applications were made at intervals of six to eight years.

Fire Protection Training

There are two areas that have been used for fire training activities at AEDC. Figure 4.4 and photographs in Appendix F illustrate the fire training areas. The initial fire protection training area (FPTA) was located north (behind) the Fire, Police and Communications Building (No. 257). This site was used from 1953 until 1983. Waste oils, paint thinners, petroleum levels, propellants, and magnesium chips were burned. Propellants, such as nitrogen tetraoxide (N_2O_4), triethylaluminum (TEA), and triethylboron (TEB), and magnesium chips were the main fuels used for training in the late 1950's and 1960's. Sodium potassium alloys (NAK) were reacted in the 1970's at the site.

All fires at FPTA No. 1 have been conducted in a steel "pan" above ground level. Due to these physical arrangements, the size of the fires conducted were small. For example, the typical pan fire at FPTA No. 1 would use only about 50 gallons of JP-4. About 24 fires were conducted per year. Halon, dry chemicals and aqueous film forming foam (AFFF) have been used as extinguishing agents.

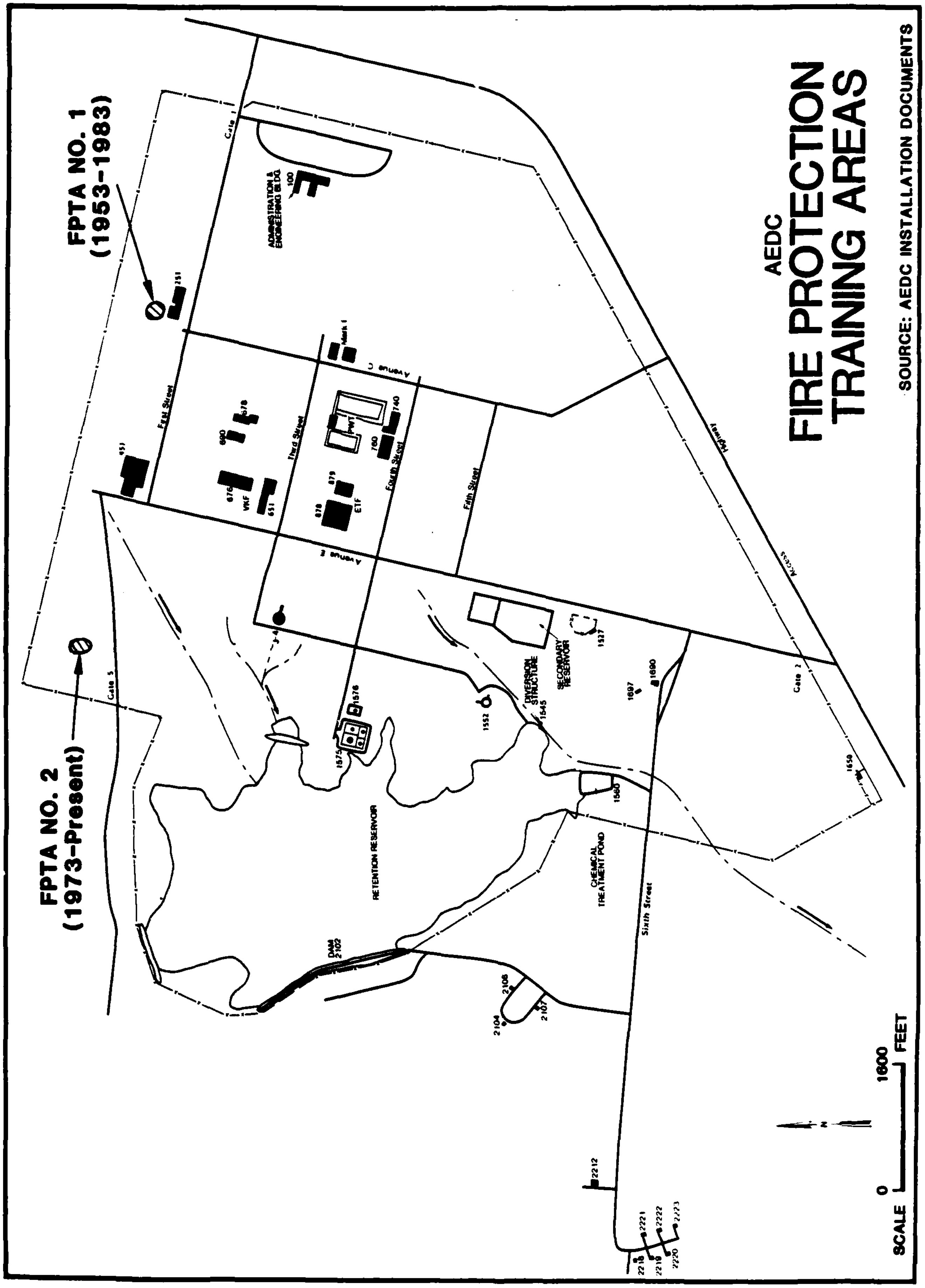
FPTA No. 2 is located northwest of the Model Shop (Building 451) near Gate 5. The facility consists of a gravel burning area with drains connected to a small retention pond. Water is first applied to the burning area followed by the combustion material. Halon, dry chemicals and AFFF are used for extinguishing fires. Unburned residuals and extinguishing agents drain to the pond or into the ground. The pond piping is arranged so that the liquid below the surface is preferentially removed and then discharged to the adjacent drainage course.

FPTA No. 2 was started in 1973 and continues in use at the present time. In the 1970's contaminated petroleum fuels and fuel filters, waste oils, thinners, solvents, and some propellants were burned. Since the late 1970's JP-4 has primarily been burned but some NAK has also been utilized. Fires typically use 500-600 gallons of JP-4 applied to the prewetted burning area. About 21 fires per year have been typical in recent years. NAK was reacted about once per year at the FPTA.

INSTALLATION WASTE DISPOSAL METHODS

A review was made of the methods used to dispose of wastes at AEDC. Information was obtained from file data and employees interviews.

FIGURE 4.4



AEDC
FIRE PROTECTION TRAINING AREAS
SOURCE: AEDC INSTALLATION DOCUMENTS
FPTA NO. 1 (1953-1983)
FPTA NO. 2 (1973-Present)
ADMINISTRATION & ENGINEERING BLDG.
100
Gate 1
Gate 2
Gate 5
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue C
Avenue E
Access Highway
VKF
ETF
PWT
Mark I
RETENTION RESERVOIR
CHEMICAL TREATMENT POND
DIVERSION STRUCTURE
SECONDARY RESERVOIR
DAM 2102
SCALE
0
1600
FEET

Following is a listing of the primary methods for disposing of AEDC wastes:

- o Landfills
- o Hardfills
- o Leaching Pits
- o Burn Areas
- o Treatment Facilities
- o Surface Drainage System

Appendix F contains photographs of many of the disposal areas discussed herein.

Landfills

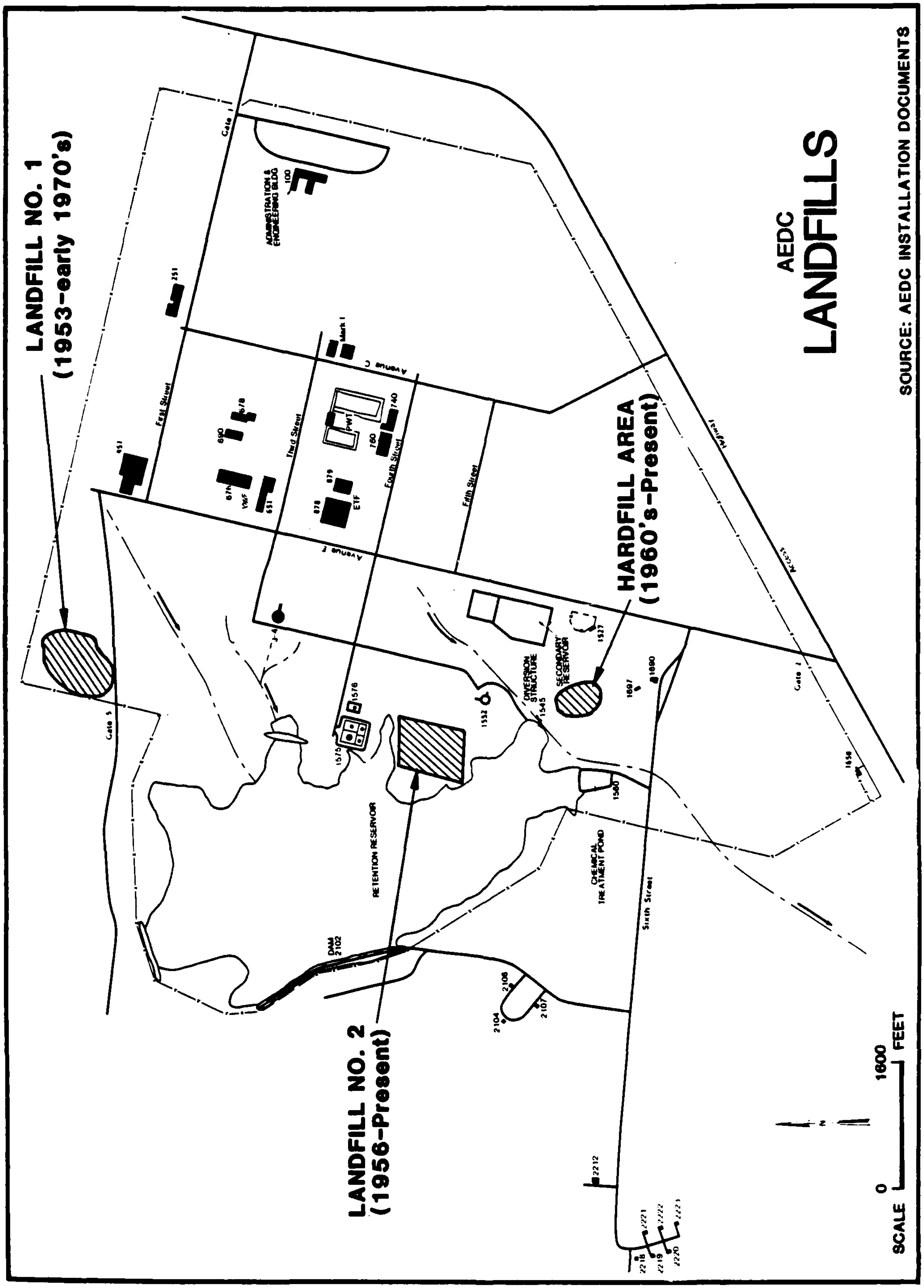
Figures 4.5 and 4.6 show the four areas that have been used for landfills at AEDC. Table 4.7 summarizes the landfill operations.

Landfill No. 1

From the time AEDC began in 1952 the area of Landfill No. 1, west of Building 450 near Gate 5, served as disposal site for many installation wastes. The site was used for disposal of construction debris in the 1960's. Facility refuse and garbage was taken to this area. In addition, some shop wastes were taken to this site, particularly for combustion (as discussed later for Burn Area No. 1). Considerable burning of wastes in a pit or trench took place for a number of years, probably until the late 1960's. The burning area and main disposal area for refuse and some shop wastes is reportedly near the small building located on the site.

Along the western edge of the landfill is a bermed area that reportedly contains ash from the AEDC power plant and ash from the Burn Area No. 1 operations. This ash would have been placed at this location until the early 1970's when coal combustion was phased out.

In the eastern and northern portion of this site many metal shop wastes, such as metal scraps and turnings, were reportedly buried. Evidence along the edges of the site also indicates concrete and other rubble may have been buried. This area now lies under and adjacent to the present FPTA No. 2.



ES ENGINEERING-SCIENCE

FIGURE 4.6

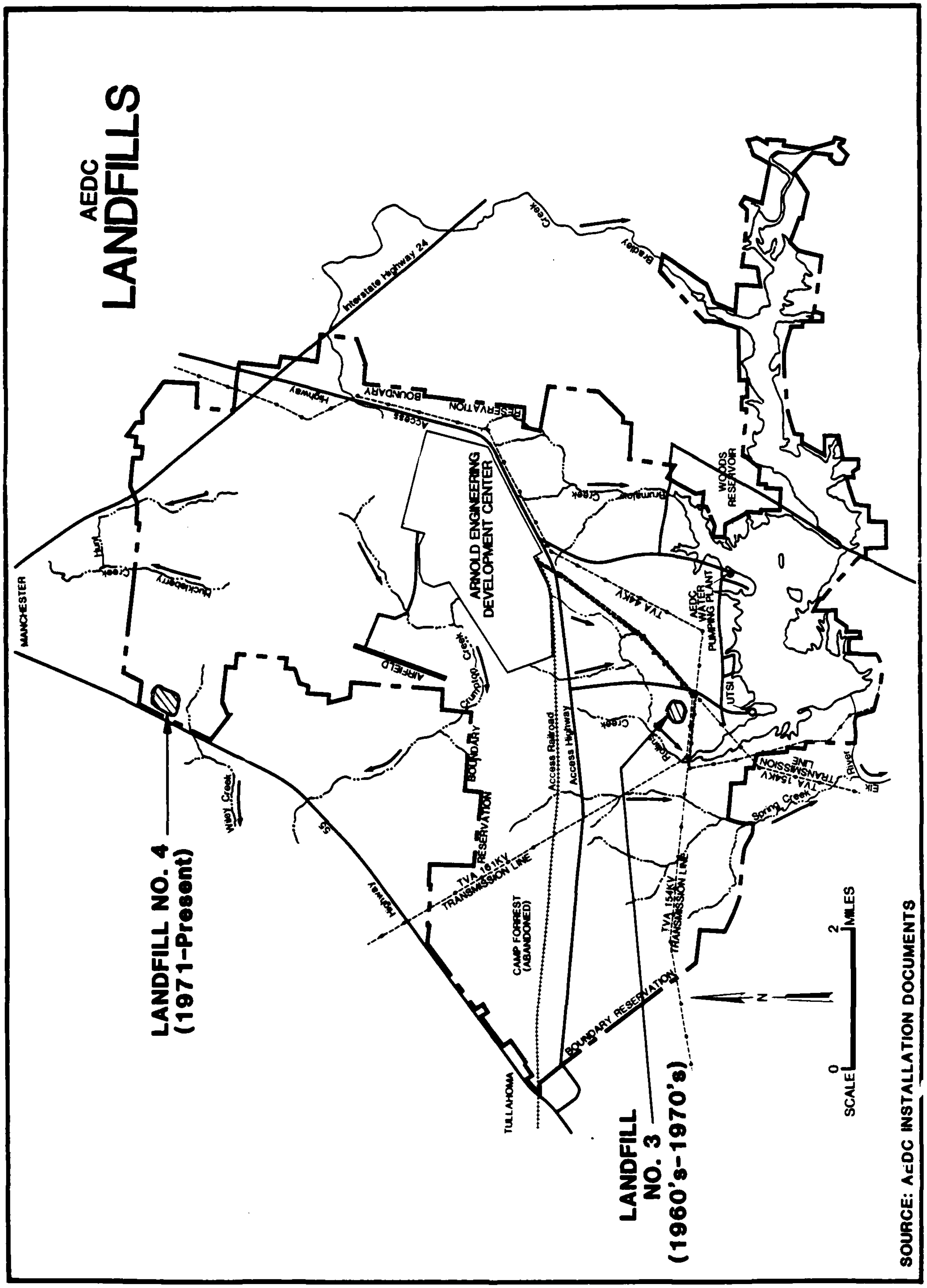

AEDC
LANDFILLS
LANDFILL NO. 4
(1971-Present)
LANDFILL
NO. 3
(1960's-1970's)
ARNOLD ENGINEERING
DEVELOPMENT CENTER
Interstate Highway 24
Access Highway
Access Railroad
BOUNDARY
RESERVATION
AIRFIELD
WOODS
RESERVOIR
AEDC
WATER
PUMPING PLANT
UTSI
TVA 44KV
TVA 161KV
TRANSMISSION LINE
TVA 154KV
TRANSMISSION LINE
CAMP FORREST
(ABANDONED)
MANCHESTER
TULLAHOMA
Highway
55
Bradley Creek
Rowland Creek
Crumpton Creek
Huckleberry Creek
Hunt
Wiley Creek
Spring Creek
Elk River
N
SCALE
0
2
MILES
SOURCE: AEDC INSTALLATION DOCUMENTS

TABLE 4.7
LANDFILL AND HARDFILL AREAS

Site	Period of Operation	Approximate Area	Method of Operation	Type of Wastes
Landfill No. 1	1953 - early 1970's	7	Predominantly trench method; depth about 8-10 ft; considerable burning (see Burn Area No. 1)	Refuse, garbage, metal scrap, concrete, power plant ash, combustible shop wastes, construction/demolition debris.
Landfill No. 2	1956 - present	15	Trench method; depth about 6-10 ft; contaminated wastes often in individual holes rather than trenches	Refuse, garbage, contaminated clothing, paints and thinners, metal salts, solvents, pesticides, acids, caustics, propellant equipment (see Appendix D for more details).
Landfill No. 3	1960's - early 1970's	3	Trench method; depth about 6-8 ft	Refuse and garbage
Landfill No. 4	1971 - present	40	Trench method; depth about 10-15 ft	Refuse, garbage, construction debris, metal salts, acids and solvents
Hardfill Area	1960's - present	3	Area/trench method; depth about 10-15 ft	Construction and demolition debris, metal scrap, wood

Source: AEDC file data and interviews.

Landfill No. 2

Landfill No. 2, designated the Sanitary Landfill in many installation files, has operated since 1956. The facility is located adjacent to the Retention Reservoir. In the period 1956 to 1970, the site was used primarily for disposal of hazardous materials. This took place along the southern edge of the present site. Hazardous wastes were typically placed in various individual holes (e.g., 6 feet by 8 feet by 6 feet deep) rather than trenches.

In approximately 1970, this site was expanded to receive refuse, garbage and other nonhazardous materials, primarily due to the closing of the Landfill No. 1 and Burn Area No. 1 operations.

Hazardous materials continued to be buried along the southern portion of the site until 1976 when this area of the landfill was closed. At that time the hazardous disposal operation was moved to a area about 200 feet north. Three trenches of reportedly nonhazard wastes are located between the two hazardous disposal areas on the site. Appendix D includes a drawing of the trenches at the landfill and also provides additional data on wastes received.

As noted in Table 4.7, this landfill received an extremely wide variety of hazardous materials. Section 3 discussed the monitoring wells at the Landfill No. 2 site. Analyses for several of the wells confirm contamination from the disposal operations (data from the wells is presented in Section 3 and Appendix D).

Active disposal operations ceased at this site in 1982 when all AEDC solid wastes, such as refuse and garbage, were transported to Landfill No. 4. Landfill No. 2 continues to dispose of asbestos, wastes, rinsed pesticide containers and small quantities of shop wastes.

Landfill No. 3

From the early 1960's until about 1970 when Landfill No. 2 was expanded, a landfill (No. 3) was operated by AEDC about a mile north of the UTSI facilities. This site received solid wastes from UTSI and AEDC facilities, such as the housing area. The wastes were primarily normal refuse and garbage and reportedly did not receive any shop wastes or hazardous materials. The closed landfill site shows some evidence of where the operations took place due to lack of trees. The site has

vegetation growth where the trenches were located and there is no evidence that contamination exists at this site.

After closure of Landfill No. 3, UTSI wastes were taken to Landfill No. 2 for a few years in the early 1970's. In the mid 1970's all UTSI wastes were taken to a disposal site off the AEDC installation, and that practice continues at the present time. The shop-type wastes and ash from the UT magneto hydrodynamic (MHD) research facility have always been taken off the AEDC reservation.

Landfill No. 4

In 1971 the northwestern corner of the AEDC reservation, near Manchester, was provided to local governments for disposal of solid wastes. The governments involved include Coffee County and the Manchester and Tullahoma municipalities. A landfill (No. 4) has operated at this location since 1971 using the trench disposal method.

Wastes received at the landfill have included household refuse and garbage, construction debris and other municipal-type materials. Several local industries have disposed wastes at this site also. In the early 1970's drums containing metal salts (mainly chromium), acids and solvents were disposed at the facility on a fairly routine basis. Since these early years, closer restrictions on wastes to be disposed have been initiated.

In 1982, all AEDC wastes such as refuse garbage have been taken to Landfill No. 4.

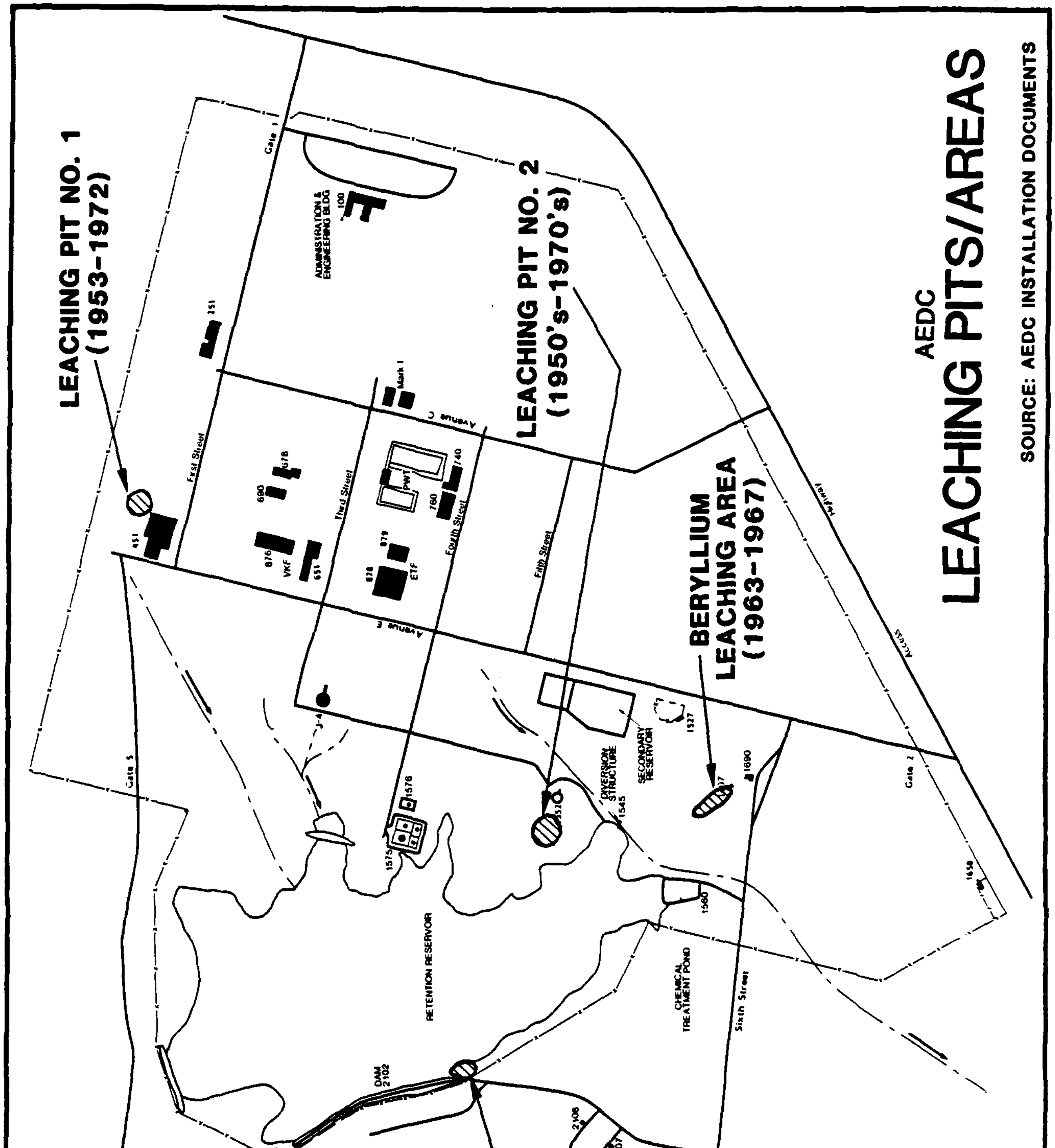
Hardfill

Figure 4.5 shows the location of a hardfill area operated at AEDC since the early 1960's. The hardfill has had more intense use since about 1970. It has received construction and demolition debris, metal scrap, wood and other nonhazardous and nonputrescible wastes. An area fill procedure has been used at the site. This hardfill is not considered to be a potential for contamination or migration of hazardous materials based upon present or past operations.

Leaching Pits

Four areas have been classified as leaching pit disposal operations. Figure 4.7 shows the location of these sites and Appendix F contains photographs of each area.

FIGURE 4.7



ES ENGINEERING-SCIENCE

Leaching Pit No. 1

Acid cleaning of metals in the Model Shop area has been conducted since AEDC began operations. Waste acids including metals were disposed of in Leaching Pit No. 1, previously located near the northwestern corner of Building 450. The leaching pit was filled with a bed of limestone rock. Waste acids disposed from the Model Shop are currently approximately 5000 gallons per year, but during the operation of this leaching pit they were probably double due to the more intense activities from the late 1950's to early 1970's. Nitric, hydrochloric, phosphoric and sulfamic acids were the primary ones disposed at this leaching pit.

In about 1972 Leaching Pit No. 1 was closed down and acid wastes were taken to Leaching Pit No. 2 near Landfill No. 2. This practice continued until the mid 1970's when neutralization facilities were constructed at the Model Shop.

Leaching Pit No. 1 has been filled in and covered with a gravel surface. However, the concrete pavement adjacent to the site is severely pitted, showing evidence of acid handling in the area.

Leaching Pit No. 2

This leaching pit (No. 2) was located adjacent to the contaminated disposal portion of Landfill No. 2. It reportedly operated from the 1950's until the 1970's. In the 1970's it received acids from the Model Shop. Prior to the 1970's it received a variety of liquid wastes which was periodically drained from drums to the pit. Wastes included chrome and other solutions from the plating operations at the Model Shop as well as other acidic wastes from various shops.

Beryllium Leaching Area

In the mid 1960's (approximately 1963 to 1967) considerable testing using beryllium took place at AEDC. Clothes contaminated with beryllium dust were washed in machines located in Building 1697. Wash water and rinsewater passed through filters on the machines and then to a pit at the back of the building. This pit overflowed to the adjacent ground area. It was estimated that clothes from about 10-15 persons were washed at this location on a regular basis. In later years, disposable clothing became more prevalent and the washing operation was closed down. All beryllium contaminated clothing went to Landfill No. 2.

Retention Leach/Burn Area

In the 1950's and 1960's a combination leaching and burning operation took place adjacent to the western edge of the Retention Reservoir. Materials leached/burned consisted primarily of toluene and propellants such as high energy fuel (HEF - alkyl borane fuel), nitrogen tetroxide, TEA and TEB. A special concrete pad was provided for unloading the waste materials (often from tank trucks) and draining them through a short, small diameter pipe to the leaching/burning area (about 20 feet diameter).

It appears from the interviews that this site may have been used to dispose of small quantities of propellants while the Camp Forrest Water Treatment Plant site handled larger volumes that needed to be disposed.

Burn Areas

Several areas at AEDC have been used to burn hazardous materials as a part of the disposal operations. Figures 4.8 and 4.9 show the burn areas and Appendix F presents photographs of some sites.

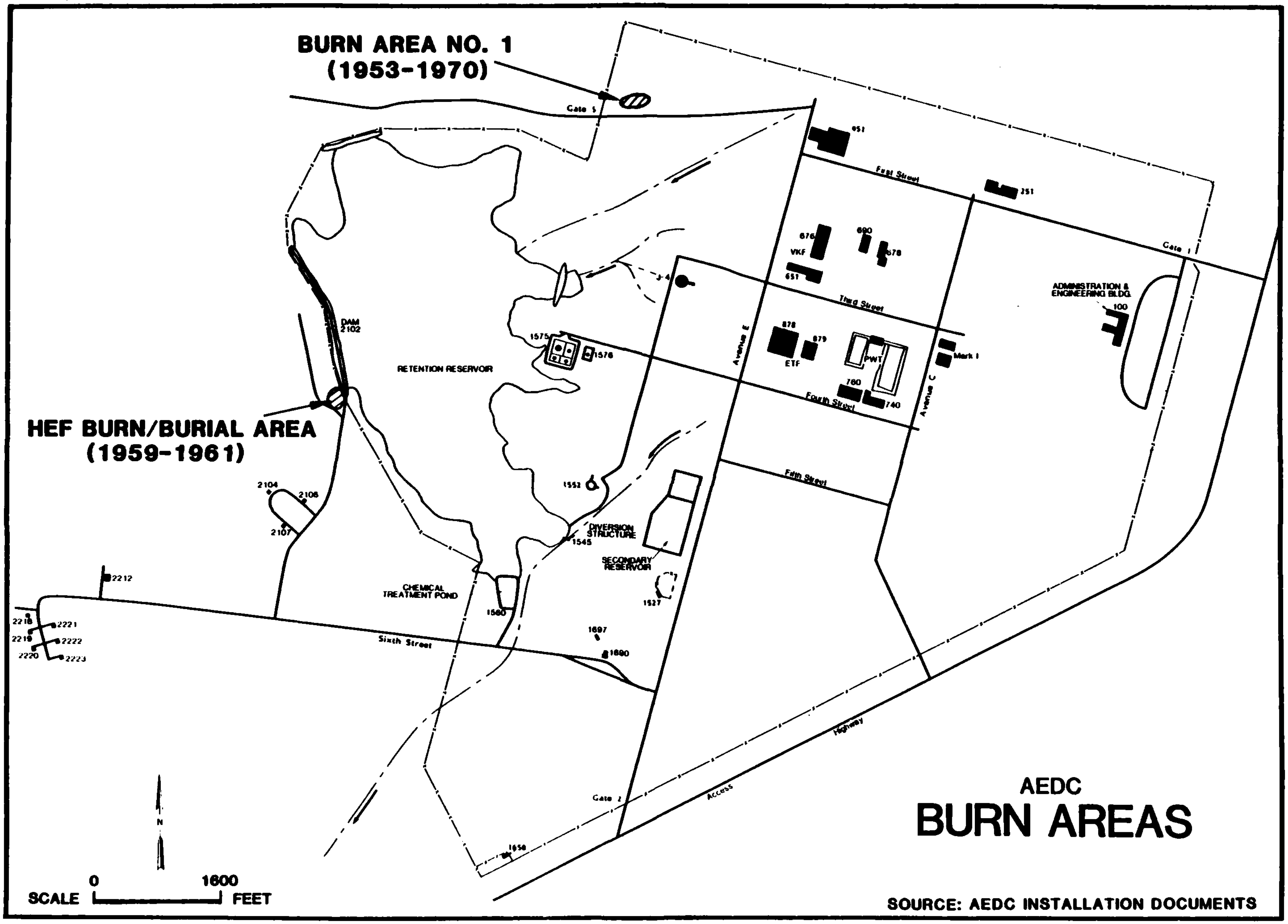
Burn Area No. 1

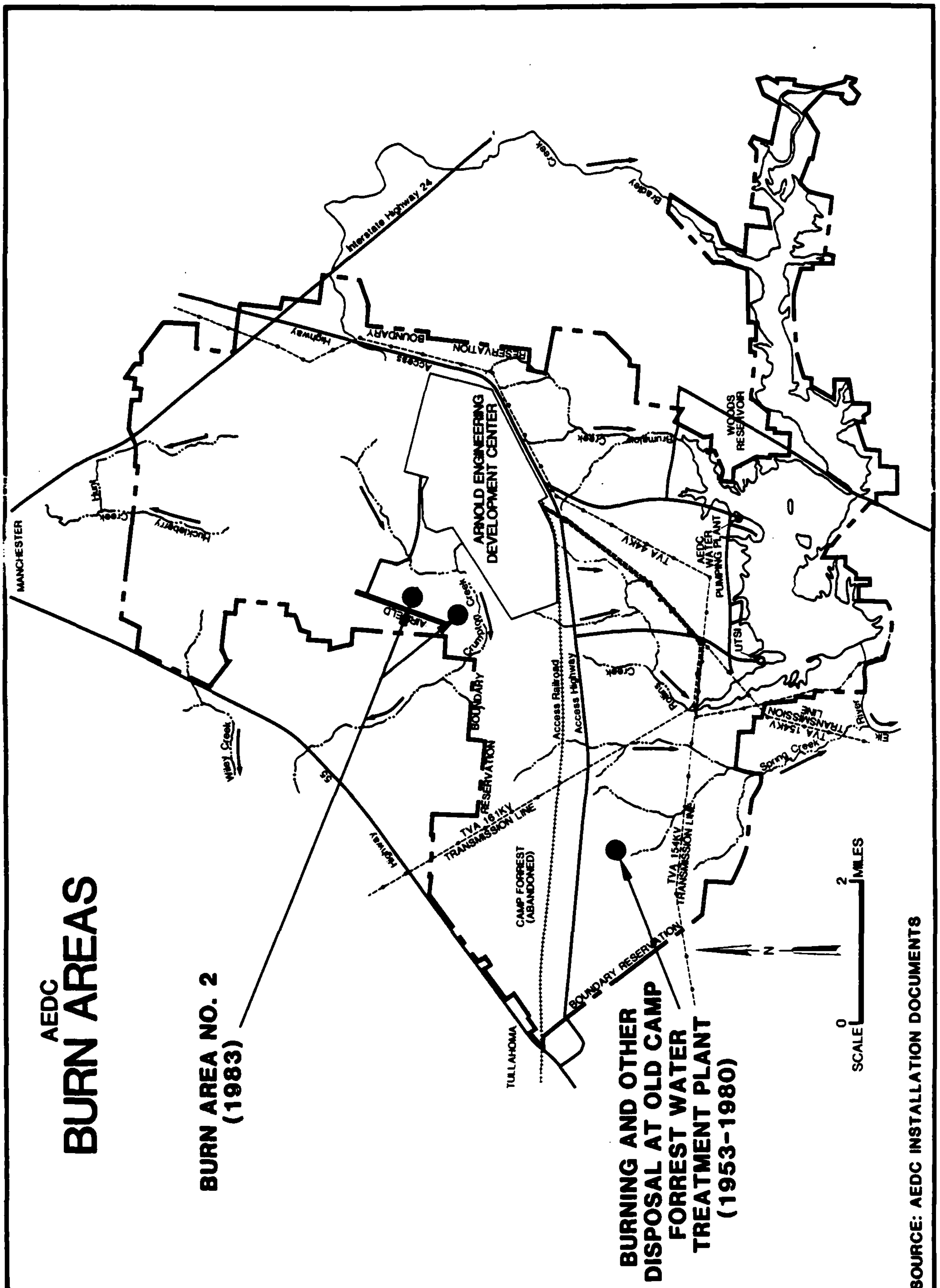
From about 1953 until the early 1970's Burn Area No. 1 operated near Gate 5, west of the Model Shop (Building 451). This burning area functioned in conjunction with the landfill disposal operations (Landfill No. 1). A pit or trench existed at the site (in the vicinity of the small building on the site). Solid wastes were placed in the trench and burned. Waste oils, contaminated fuels, solvents, thinners and other combustible wastes were burned on a regular basis. In the early 1970's this open burning was phased out as solid waste disposal became more of a sanitary landfill type operation at Landfill No. 2. The combustible shop wastes being burned were then predominantly taken to one of the fire protection training areas, the contaminated disposal area at Landfill No. 2, and/or the steam plant.

Burn Area No. 2

In 1983 a significant quantity of solid rocket fuel required disposal. Permission was obtained from appropriate regulatory agencies to burn this material at AEDC. Two areas at the AEDC Airfield were used; the northern area was a small site used to test the combustion procedure, and the southern site was where most of the fuel was burned. The

FIGURE 4.8


BURN AREA NO. 1
(1953-1970)
HEF BURN/BURIAL AREA
(1959-1961)
Gate 5
Gate 1
Gate 2
651
251
First Street
Third Street
Fourth Street
Fifth Street
Sixth Street
Avenue E
Avenue C
676
VKF
680
678
651
878
879
ETF
PWT
760
740
Mark I
ADMINISTRATION & ENGINEERING BLDG.
100
J-4
DAM
2102
RETENTION RESERVOIR
1575
1576
1552
DIVERSION STRUCTURE
1545
SECONDARY RESERVOIR
1527
CHEMICAL TREATMENT POND
1560
1697
1690
2104
2106
2107
2212
2218
2219
2220
2221
2222
2223
1650
Access Highway
N
SCALE 0 1600 FEET
AEDC
BURN AREAS
SOURCE: AEDC INSTALLATION DOCUMENTS


AEDC
BURN AREAS
BURN AREA NO. 2
(1983)
BURNING AND OTHER
DISPOSAL AT OLD CAMP
FORREST WATER
TREATMENT PLANT
(1953-1980)
ARNOLD ENGINEERING
DEVELOPMENT CENTER
MANCHESTER
TULLAHOMA
Interstate Highway 24
Highway 55
Access Highway
Access Railroad
BOUNDARY RESERVATION
RESERVATION BOUNDARY
CAMP FORREST
(ABANDONED)
TVA 161KV
TRANSMISSION LINE
TVA 154KV
TRANSMISSION LINE
TVA 44KV
AEDC
WATER
PUMPING PLANT
WOODS
RESERVOIR
UTSI
AIRFIELD
Wiley Creek
Huckleberry Creek
Crumpton Creek
Brumalow Creek
Bradley Creek
Rollins Creek
Spring Creek
Elk River
SCALE
0
2
MILES
N
SOURCE: AEDC INSTALLATION DOCUMENTS

material was spread on the ground and ignited. No other waste disposal has taken place at the Airfield site.

HEF Burn/Burial Area

Another one-time-only burning area was adjacent to the western edge of the Retention Reservoir, located generally in the vicinity of the Retention Leach/Burn Area. At this site, containers of high energy fuel (HEF) were placed in a trench. The containers were then detonated and the fuel burned. Following combustion, the exploded containers were covered with soil in the trench. This burning and burial operation reportedly took place between 1959 and 1961.

Camp Forrest Water Treatment Plant

The old water treatment plant that served the Camp Forrest activities during World War II was used as a major disposal site for AEDC wastes from 1953 until 1980. The treatment plant foundation was a concrete structure which consisted of various tanks. Wastes were burned, ignited or reacted in the tanks. Materials disposed included a wide variety of propellants, such as HEF, nitrogen tetroxide, red fuming nitric acid (RFNA), unsymmetrical dimethylhydrazine (UDMH), aerozine (AZ-50, a mixture of UDMH and hydrazine), and other wastes including NAK, oils, solvents, jet fuels and solid rocket fuel.

The clear well at the old treatment plant was used as a deposit area for contaminated pipe, tubes, valves and other mechanical equipment. A pit adjacent to the concrete tanks was used to bury contaminated containers and drums after the contents was burned or otherwise disposed in the tanks.

In the past few years the water treatment plant structures at Camp Forrest were demolished and the entire site filled in and graded. An opening to the old clear well still appears to be accessible.

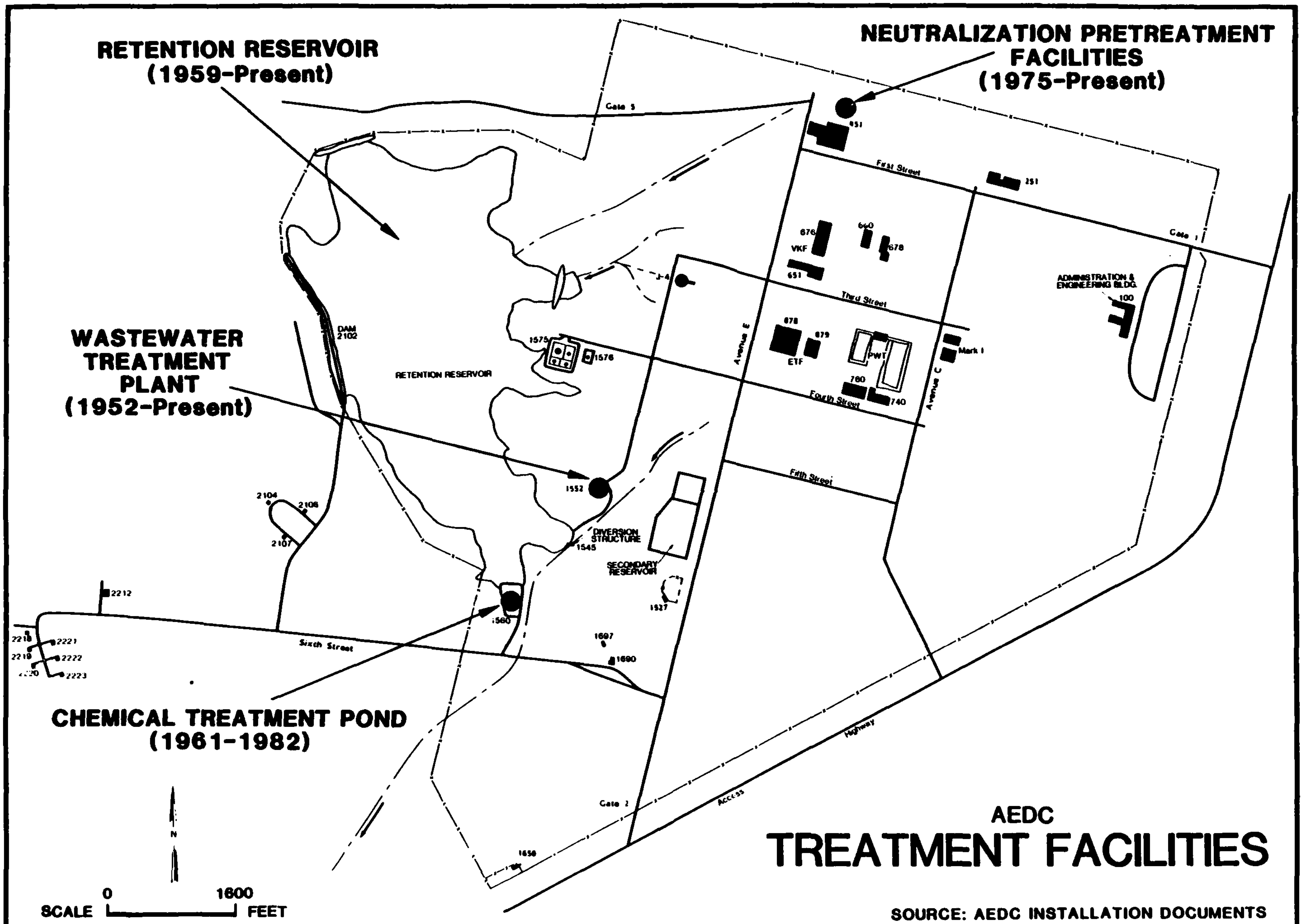
Treatment Facilities

Four facilities at AEDC have been used to treat hazardous materials (Figure 4.10).

Wastewater Treatment Plant

The main wastewater treatment plant (Facility 1552), located near the east side of the Retention Reservoir, has received some small quantities of hazardous materials since AEDC began operations. Other

FIGURE 4.10



AEDC
TREATMENT FACILITIES

SOURCE: AEDC INSTALLATION DOCUMENTS

wastewater treatment plants operated by AEDC are for remote facilities which predominantly receive domestic sewage.

Rinsewaters from Model Shop plating and anodizing operations have routinely been drained to the wastewater treatment plant. Dilute acids and bases are utilized for various processes throughout the AEDC testing areas. These spent solutions, usually small volumes, are discharged to the sanitary sewer system. Ethylene glycol and water solutions are sent to the sanitary system as are photographic process solutions. Since about 1966 silver has been recovered from the photographic wastes prior to discharge. There have been periodic spills of other materials, such as fuel, which have on occasion reached the wastewater treatment plant. These spills were more typical in the 1960's and early 1970's.

Although there have been some operational upsets in the wastewater treatment, possibly due to some of the industrial-type wastes, the plant has generally performed as required. Sludge from the plant is dried and has been disposed of with top soil at many locations throughout the AEDC site.

The sanitary sewerage system is not considered a potential for contamination or migration of hazardous materials based upon present or past operations.

Neutralization Pretreatment Facilities

In about 1975 pretreatment tanks were constructed adjacent to Building 450 to hold all acidic wastes generated at the Model Shop. Wastes are discharged to the sanitary sewer system relatively infrequently, but the facilities enable neutralization prior to discharge. These facilities replace the leaching pit operation described previously.

These facilities are not considered a potential for contamination or migration of hazardous materials based upon the present or past operations.

Chemical Treatment Pond

The Chemical Treatment Pond, located at the south end of the Retention Reservoir, was constructed in 1961 and utilized until 1982. It is an unlined pond. No inlet conveyance facilities such as sewers are provided; all materials to be treated were brought to the site in drums or other containers. Containers were typically rinsed at the site by

fire department personnel. The pond contents can be discharged through a gate to the Rollins Creek Surface Drainage System or pumped into the Retention Reservoir.

Typical waste materials disposed of at the Chemical Pond have included caustic soda, RFNA, aerozine, hydrazine, nitrogen tetroxide, strontium perchlorate, and toluene. Most of these wastes were reacted with the water or merely held in the pond to enable some treatment prior to discharge. HTH (chlorine compound) was added to the pond to assist in oxidizing some wastes such as hydrazine.

Retention Reservoir

The Retention Reservoir is a large impoundment located at the western edge of the AEDC testing areas. The reservoir was constructed in 1953 and has been operated since that time. The primary objective of the unlined reservoir is to enable waste materials, primarily oils, which reach the Rollins Creek Surface Drainage System to be diverted for a holding or treatment period before release to the surface streams. The reservoir also receives direct runoff from the J-4 testing area. The useful storage capacity of the reservoir is approximately 976 acre-feet (318 million gallons). The reservoir has also been used to receive waste materials hauled to the site for disposal.

The types of wastes known to have been diverted to the Retention Reservoir include oils, PCB-contaminated oils, jet fuels, monomethylhydrazine (MMH), UDMH, aerozine, nitrogen tetroxide, strontium perchlorate, toluene and propellant combustion residuals.

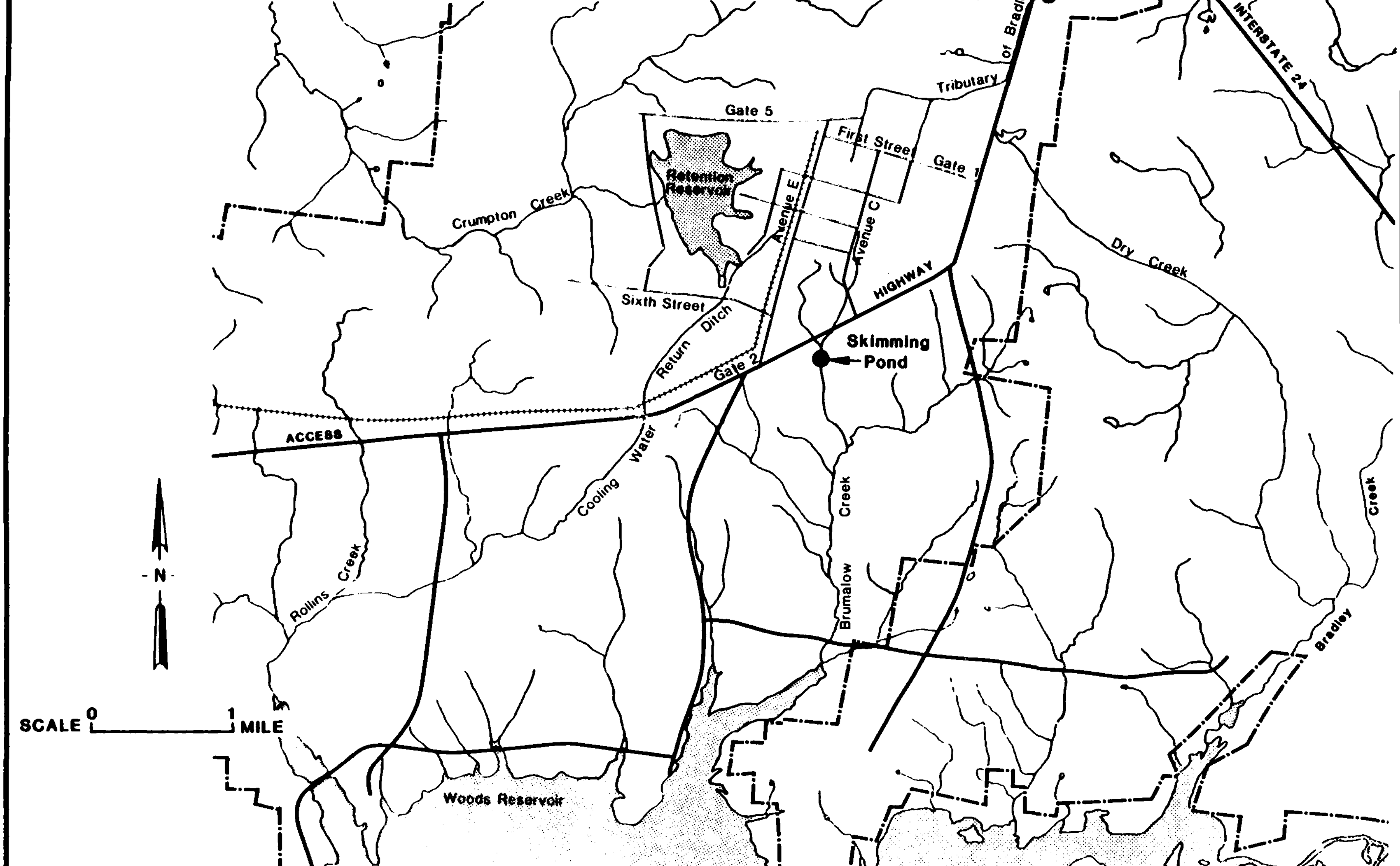
Diversion from the surface drainage system is accomplished by motor-driven channel and reservoir gates (see photograph in Appendix F). When the wastes in the drainage channel have subsided, the above procedure is reversed. Testing is done periodically on the Retention Reservoir water to determine when it can be released back to the drainage channel. Testing has also been done on fish caught in the reservoir and elevated PCB levels have been indicated.

Surface Drainage Systems

As previously discussed in Section 3, there are four distinct drainage areas leading away from the AEDC operations area (Figure 4.11). Each of these areas has operated since 1953 and has received or is suspected to have received hazardous wastes, primarily from spills and

FIGURE 4.11

AEDC
SURFACE DRAINAGE SYSTEMS



SOURCE: USGS MAP (MODIFIED) AND INSTALLATION DOCUMENTS

leaks which directly reach the storm drains or from runoff of areas which routinely have been subject to spills and leaks.

Rollins Creek

The drainage system to Rollins Creek is the most significant drainage course at AEDC. This channel transports large cooling water return flows from the Test Areas to Woods Reservoir via Rollins Creek. As described previously, contaminated flows may be directed to the Retention Reservoir for holding/treatment before release to the surface stream. However, prior to construction of the reservoir (1959) any contaminated waters were transported to Rollins Creek. This drainage system also receives effluent from the main AEDC wastewater treatment plant and the Chemical Treatment Pond. Runoff from a large portion of AEDC, including much of the ETF testing area, enters the Rollins Surface Drainage System. Hazardous wastes are known to have been transported by this drainage system.

Bradley Creek

Much of the northeastern portion of AEDC is tributary to Bradley Creek via a series of drainage ditches. The most significant is Ditch H which serves all of the VKF and part of the ETF testing areas as well as the Model Shop operations. This drainage system has received hazardous waste spills from both the testing areas and the Model Shop. A pond with an oil skimmer exists for this drainage system near the installation boundary (Figure 4.11). The skimming pond was installed in 1972-1973. It has been cleaned twice with the dredged material placed immediately adjacent to it.

Brumalow Creek

The Brumalow Surface Drainage System serves the southeastern portion of AEDC. Runoff and/or spills from the PWT testing area, steam plant and motor pool enter this system. Some hazardous material spills and leaks have occurred in the Brumalow Creek System. A pond with an oil skimmer has been operated for this drainage system south of the AEDC access road (Figure 4.11) since 1972-1973. It has been cleaned twice and the dredged material placed immediately adjacent to the pond.

Crumpton Creek and J-4 Area

The drainage area for Crumpton Creek originally included much of the western portion of AEDC. When the Retention Reservoir was

constructed in 1959 most of the drainage entered the reservoir instead of Crumpton Creek. For example, all surface drainage from the J-4 area enters directly into the Retention Reservoir. It is reported that some seepage from the Retention Reservoir Dam regularly discharged to Crumpton Creek and is suspected to have received some hazardous materials from the reservoir.

Miscellaneous

Camp Forrest Army Operations

Prior to development of the AEDC facilities, part of the reservation area served as training grounds for the Army during World War II. The training area, Camp Forrest, was located on both sides of the access road which leads from the AEDC main gate to Tullahoma.

Incinerators were provided at the camp and these were probably used to dispose of wastes generated by the troop encampment. A sewage treatment plant also existed. Based upon the facilities provided and the training activities which were undertaken, there is reason to believe the old camp area has no potential to create environmental contamination.

Camp Forrest activities also involved artillery range training. Two major locations on the AEDC reservation have been identified as artillery impact areas. One area straddles Rollins Creek just south of the AEDC access area (east of the UTSI access road). The other abandoned artillery impact zone is just north of the AEDC Airfield. A few other small areas on the reservation are also posted with warning signs. While these areas may pose safety problems, they are judged to have minimal potential to create environmental contamination.

Road Oiling

Another disposal activity which existed at AEDC for a number of years (to about 1970's) was use of waste oils to control dust on unpaved roads. The roads south of the AEDC access highway and those leading to the landfill operations were oiled periodically. Data concerning the frequency of application, volume of oil used and specific roads receiving the oils was not available. Crankcase oils are known to have been used for this purpose and the use of hydraulic, capacitor and transformer oils is believed to have been minimal, if any. It is judged that

the road oiling operations are likely to cause minimal environmental contamination.

EVALUATION OF PAST DISPOSAL ACTIVITIES AND FACILITIES

Review of past waste generation and management practices at AEDC has resulted in identification of 34 sites and/or activities which were considered as areas of concern for potential contamination and migration of contaminants.

Sites Eliminated from Further Evaluation

The sites of initial concern were evaluated using the Flow Chart presented in Figure 1.2. Sites not considered to have a potential for contamination were deleted from further evaluation. The sites which have potential for contamination and migration of contaminants were evaluated using the Hazard Assessment Rating Methodology (HARM). Table 4.8 summarizes the results of the flow chart logic for each of the areas of initial concern.

Twelve of the 34 sites assessed did not warrant further evaluation. The rationale for omitting these sites from HARM evaluation is discussed below.

The test and bulk fuel farms have experienced a few small spills. The test fuel storage area had one larger spill but nearly all was recovered. Therefore, these operations do not suggest potential contamination.

The waste accumulation points and waste storage areas have not experienced any major spills or leak problems so the potential contamination at these sites should be minimal. The leaks from a few drums at the Chemical Storage Area were small and thus this area is not considered for additional evaluation. The leak from the water treatment plant fuel tank is believed to have been small and thus minimal potential for environmental contamination. Similarly, pesticide handling at two different sites does not suggest potential environmental contamination.

Landfill No. 3 operated for less than ten years serving the UTSI and AEDC facilities near Woods Reservoir such as the housing area. Wastes disposed were normal refuse and garbage, and no evidence of hazardous waste exists. Visual observations at the site do not indicate

TABLE 4.8
SUMMARY OF FLOW CHART LOGIC FOR AREAS OF
INITIAL HEALTH, WELFARE AND ENVIRONMENTAL CONCERN AT AEDC

Site	Potential Hazard to Health, Welfare or Environment	Need for Further IRP Evaluation/ Action	HARM Rating
Test Fuel Farm	No	No	No
Bulk Fuel Farm	No	No	No
Waste Storage Areas	No	No	No
Waste Accumulation Points	No	No	No
Testing Area Spills/Leaks	Yes	Yes	Yes
Model Shop Spills/Leaks	Yes	Yes	Yes
Chemical Storage Area Leaks	No	No	No
Water Treatment Plant Fuel Leak	No	No	No
Pesticide Handling	No	No	No
Fire Protection Training Area No. 1	Yes	Yes	Yes
Fire Protection Training Area No. 2	Yes	Yes	Yes
Landfill No. 1	Yes	Yes	Yes
Landfill No. 2	Yes	Yes	Yes
Landfill No. 3	No	No	No
Landfill No. 4	Yes	Yes	Yes
Hardfill Area	No	No	No
Leaching Pit No. 1	Yes	Yes	Yes
Leaching Pit No. 2	Yes	Yes	Yes
Beryllium Leaching Area	Yes	Yes	Yes
Retention Leach/Burn Area	Yes	Yes	Yes
Burn Area No. 1	Yes	Yes	Yes
Burn Area No. 2	Yes	Yes	Yes
HEF Burn/Burial Area	Yes	Yes	Yes
Camp Forrest Water Treatment Plant	Yes	Yes	Yes
Wastewater Treatment Plant	No	No	No
Neutralization Pretreatment Facilities	No	No	No
Chemical Treatment Pond	Yes	Yes	Yes
Retention Reservoir	Yes	Yes	Yes
Surface Drainage - Rollins	Yes	Yes	Yes
Surface Drainage - Bradley	Yes	Yes	Yes
Surface Drainage - Brumalow	Yes	Yes	Yes
Surface Drainage - Crumpton	Yes	Yes	Yes
Surface Drainage - J-4 Area	Yes	Yes	Yes
Camp Forrest Army Operations	No	No	No
Road Oiling	No	No	No

Source: Engineering-Science

vegetative stress. Therefore, this site was eliminated from further evaluation. This same conclusion is drawn for the hardfill area as no evidence of hazardous waste disposal exists.

Both the wastewater treatment plant and neutralization pretreatment facilities have handled hazardous materials. Minor upsets have occurred at the wastewater treatment plant, primarily in the 1960's and early 1970's. There is no indication of leakage from the neutralization pretreatment tanks. Therefore, these two facilities have been eliminated from further assessment.

The Army activities at Camp Forrest during World War II involved solid waste disposal using incinerators and a wastewater treatment plant for liquid wastes. Artillery impact areas exist but are considered a potential safety hazard rather than an environmental contamination problem. The Army operations were not evaluated further.

Road oiling took place for many years at numerous locations on the AEDC reservation. The oils used were primarily crankcase oils and the potential for environmental contamination was considered minimal.

Sites Evaluated Using HARM

The remaining 22 sites identified in Table 4.8 were evaluated using the Hazard Assessment Rating Methodology. The HARM process takes into account characteristics of potential receptors, waste characteristics, pathways for migration, and specific characteristics of the site related to waste management practices. Results of the HARM analysis for the sites are summarized in Table 4.9. It is noted that due to the close proximity of several sites the rating has been combined. The response of the Model Shop spills/leaks was evaluated as a part of the Bradley Surface Drainage System.

The procedures used in the HARM system are outlined in Appendix G and the specific rating forms for the seventeen sites at AEDC are presented in Appendix H. The HARM system is designed to indicate the relative need for follow-on action.

TABLE 4.9
SUMMARY OF HARM SCORES FOR
POTENTIAL CONTAMINATION SOURCES AT AEDC

Rank	Site	Receptor Subscore	Waste Characteristics Subscore	Pathways Subscore	Waste Management Factor	HARM Score
1	Landfill No. 2/Leaching Pit No. 2	40	100	100	1.0	80
2	Retention Reservoir/J-4 Area Surface Drainage	38	100	100	1.0	79
3	Landfill No. 4	59	100	74	1.0	78
4	Surface Drainage-Bradley	49	100	69	1.0	73
5	Surface Drainage-Rollins	43	100	69	1.0	71
6	Camp Forrest Water Treatment Plant	36	100	74	1.0	70
7	Testing Areas	42	100	67	1.0	70
8	Leaching Pit No. 1	42	100	67	1.0	70
9	Surface Drainage-Brumalow	50	70	69	1.0	63
10	Fire Protection Training Area No. 2/Burn Area No. 1/Landfill No. 1	38	80	67	1.0	62
11	Chemical Treatment Pond	38	80	67	1.0	62
12	Retention Leach/Burn Area	36	80	69	1.0	62
13	Fire Protection Training Area No. 1	42	64	67	1.0	58
14	Surface Drainage-Crumpton	34	56	69	1.0	53
15	HEF Burn/Burial Area	36	48	69	1.0	51
16	Beryllium Leaching Area	38	30	67	1.0	45
17	Burn Area No. 2	46	24	59	1.0	43

Source: Engineering-Science

SECTION 5
CONCLUSIONS

The goal of the IRP Phase I study is to identify sites where there is potential for environmental contamination resulting from past waste disposal practices and to assess the probability of contaminant migration from these sites. The conclusions given below are based on field inspections; review of records and files; review of the environmental setting; interviews with AEDC present and past employees and local, state and federal government employees; and assessments using the HARM system. Table 5.1 contains a list of the potential contamination sources identified at AEDC and a summary of the HARM scores for those sites.

LANDFILL NO. 2/*LEACHING PIT NO. 2 (SITE NO. 1)*

The area which comprises Landfill No. 2 and Leaching Pit No. 2 has caused environmental contamination as evidenced from existing shallow ground water monitoring well analytical data. This site requires some Phase II IRP investigative activities to determine the extent of contaminant migration; however, some concurrent remedial response activities under Phase IV (such as a remedial action plan) may also be necessary. Landfill No. 2 and Leaching Pit No. 2 received a large quantity of numerous hazardous materials including acids, caustics, propellant equipment, metal salts, solvents, pesticides, oils, paints and thinners. The landfill received mainly hazardous wastes from 1956 until about 1970 when refuse was also buried in trenches at the site. The leaching pit operated from the 1950's to the 1970's. It received all the Model Shop acids and other liquid chemical wastes when Leaching Pit No. 1 was closed down in 1972. The waste characteristics and pathways subscores result in a final HARM score of 80 for these facilities.

TABLE 5.1
SITES EVALUATED USING THE
HAZARD ASSESSMENT RATING METHODOLOGY
AEDC

Site No./ Rank	Site Description	Operation Period	HARM Score[1]
1	Landfill No. 2/ Leaching Pit No. 2	1956-Present 1950's-1970's	80
2	Retention Reservoir/ J-4 Area Surface Drainage	1959-Present	79
3	Landfill No. 4	1971-Present	78
4	Surface Drainage - Bradley	1953-Present	73
5	Surface Drainage - Rollins	1953-Present	71
6	Camp Forrest Water Treatment Plant	1953-1980	70
7	Testing Areas	1953-Present	70
8	Leaching Pit No. 1	1953-1972	70
9	Surface Drainage - Brumalow	1953-Present	63
10	Fire Protection Training Area No. 2/Burn Area No. 1/ Landfill No. 1	1973-Present 1953-1970	62
11	Chemical Treatment Pond	1961-1982	62
12	Retention Leach/Burn Area	1950's-1960's	62
13	Fire Protection Training Area No. 1	1953-1983	58
14	Surface Drainage - Crumpton	1953-Present	53
15	HEF Burn/Burial Area	1959-1961	51
16	Beryllium Leaching Area	1963-1967	45
17	Burn Area No. 2	1983	43

(1) This ranking was performed according to the Hazard Assessment Rating Methodology (HARM) described in Appendix G. Individual rating forms are in Appendix H.

RETENTION RESERVOIR/J-4 AREA SURFACE DRAINAGE (SITE NO. 2)

The surface drainage from the rocket test areas and the Retention Reservoir have sufficient potential to create environmental contamination to warrant follow-on investigations. Fish in the reservoir are known to have been contaminated by wastes entering the impoundment. These unlined drainage/impoundment facilities have received propellants and propellant residuals, petroleum fuels, oils, PCB-contaminated oils, and other waste materials. All contaminated flows in the Rollins Surface Drainage System have been diverted since 1959 to the Retention Reservoir for holding and pretreatment before release back to the drainage system. The waste characteristics and pathways result in a total HARM score of 79 for these operations.

LANDFILL NO. 4 (SITE NO. 3)

The landfill (No. 4) which is operated by Coffee County-Manchester-Tullahoma in the northwestern corner of the AEDC installation has sufficient potential to create environmental contamination (ground water), and follow-on studies are justified. For several years, in the early 1970's, when this landfill started operations, liquid and semi-solid industrial wastes in drums were accepted and buried. These wastes included acids, metal salts, solvents and other hazardous materials which represent a potential for contamination of the ground water. The relatively high ranking of this site, is primarily due to its receptor subscore which reflects the locational aspects concerning nearby populations (residents and high school), installation boundary, wells and residential land use. The total final HARM Score for Landfill No. 4 is 78.

SURFACE DRAINAGE - BRADLEY (SITE NO. 4)

The drainage courses and skimming pond at AEDC which lead to Bradley Creek have sufficient potential to create environmental contamination to justify further follow-on investigations. Spills and leaks and surface runoff from the Model Shop, Leaching Pit No. 1 and Testing Areas (mainly VKF and part of ETF) have drained to the Bradley Creek area since the installation began operations. Wastes can include acids, caustic, metals, solvents, oils, fuels and other chemicals. These

characteristics, plus the pathways subscore contribute to the total HARM score of 73.

SURFACE DRAINAGE - ROLLINS (SITE NO. 5)

The main cooling water return channel at AEDC, which drains to Rollins Creek, has sufficient potential to create environmental contamination and follow-on studies are warranted. This drainage course has handled contaminated wastes by diverting them to the Retention Reservoir since 1959 or to Woods Reservoir from 1953 to 1959. The drainage system receives spills and leaks and surface runoff from a major portion of the Testing Areas, all return cooling flows from the AEDC industrial facilities and wastewater treatment plant effluent. All barometric wells in the Testing Areas, which serve to collect liquid wastes, discharge to the Rollins drainage system. The waste characteristics and pathways subscores result in a 71 total HARM score.

CAMP FORREST WATER TREATMENT PLANT (SITE NO. 6)

The Camp Forrest Water Treatment Plant site has sufficient potential to create environmental contamination, and follow-on investigations are warranted. This site was the recipient of many AEDC wastes over a long period of time (1953-1980). Many wastes were burned or otherwise accumulated either within the old treatment plant structure or adjacent to it. The waste characteristics and locational aspects of the receptor evaluation resulted in a total HARM score of 70.

TESTING AREAS (SITE NO. 7)

The PWT, ETF and VKF Testing Areas have sufficient potential to create environmental contamination and follow-on investigations are justified. The industrial-oriented activities in the Testing Areas have been subject to routine spills and leaks of petroleum products and other chemicals since 1953 when AEDC began operations. The waste characteristics and the pathways subscores resulted in a total HARM score of 70 for the Testing Areas.

LEACHING PIT NO. 1 (SITE NO. 8)

The leaching pit (No. 1) previously located by the Model Shop has sufficient potential to create environmental contamination to warrant follow-on studies. A large variety of acids, alkalies and other chemicals were disposed in this leaching pit over a number of years (1953-1972). Several spills of acids also occurred in this vicinity which is tributary to Bradley Creek via Ditch H. The waste characteristics and receptor subscores primarily contributed to the total HARM score of 70.

SURFACE DRAINAGE - BRUMALOW (SITE NO. 9)

This surface drainage system and skimming pond, leading to Brumalow Creek, has sufficient potential to create environmental contamination to warrant follow-on investigation. The drainage system serves the PWT, steam plant and motor pool areas, including all spills, leaks and surface runoff which results from the industrial activities. This system has functioned for numerous years and the waste characteristics and pathways result in a total HARM score of 63.

FIRE PROTECTION TRAINING AREA NO. 2/BURN AREA NO. 1/LANDFILL NO. 1 (SITE NO. 10)

This site, near Gate 5, has served as a multipurpose disposal area and has sufficient potential to create environmental contamination to justify follow-on studies. The area from 1952 to about 1970 was used as a combination dump and burning area ("fire pit") for waste petroleum products, propellants and other combustible wastes. The area under the present Fire Protection Training Area No. 2 was used primarily as a landfill, receiving metal scraps and other debris. The fire training activities have included burning of waste materials after pre-application of water to the gravel combustion surface. Along the western border of this disposal site, ashes from the power plant were buried. The variety of wastes and potential pathways results in a final HARM score of 62.

CHEMICAL TREATMENT POND SITE (NO. 11)

The Chemical Treatment Pond has sufficient potential to create environmental contamination to justify follow-on study. This facility, which operated from 1961 to 1982, was used to treat and dispose of several different propellants and toluene. Due to the waste characteristics and pathways subscores, this site received a total HARM score of 62.

RETENTION LEACH/BURN AREA (SITE NO. 12)

This leaching and burning area, which handled propellants and toluene in the 1950's, has sufficient potential to create environmental contamination to warrant additional follow-on study. This site received a HARM score of 62 primarily due to the waste characteristics and pathways analyses.

FIRE PROTECTION TRAINING AREA NO. 1 (SITE NO. 13)

FPTA No. 1 burned waste oils, magnesium, petroleum fuels and test fuels from the 1950's until 1983. All of the fires were conducted in a steel "pan" which was constructed above ground level. Some spillage of the combustion materials, before, during and after the fires, took place. However, the quantity of wastes reaching the ground is not estimated to be large. Based upon the burning practices and the receptor analysis, this site is judged to have minimal potential to create environmental contamination, and no additional investigation is warranted. The HARM score for FPTA No. 1 was 58.

SURFACE DRAINAGE - CRUMPTON (SITE NO. 14)

This drainage area has only received leakage from the Retention Reservoir which has contained a variety of wastes. The HARM rating for the Crumpton Creek Drainage System was 53. There is reason to believe that this facility has minimal potential to create environmental contamination. Thus, unless other data are collected to support the need for additional investigation, none is warranted.

HEF BURN/BURIAL AREA (SITE NO. 15)

This site involved a one-time disposal of propellant. Containers were placed in a trench near the Retention Reservoir and then exploded and burned. The residual combustion products and the containers were buried in place. The HARM score for the HEF Burn/Burial Area is 51. This site is judged to create minimal environmental contamination, and no further study is justified.

BERYLLIUM LEACHING AREA (SITE NO. 16)

At this site, washwaters from machines used for cleaning contaminated beryllium clothing in the mid 1960's were discharged to a pit which drained to the land adjacent to Building 1697. The residual beryllium wastes are estimated to be in small quantities for the relative few years of operation. The total HARM score was 45. This site is believed to have minimal potential to create environmental contamination, and no additional investigations are warranted.

BURN AREA NO. 2 (SITE NO. 17)

This site, located at the AEDC Airfield, was used on only one occasion (1983) to burn waste solid rocket fuel. The residual wastes following burning were small. The burn area received a HARM score of 43. Burn Area No. 2 is judged to have minimal potential to create environmental contamination, and no further investigation is necessary.

SECTION 6
RECOMMENDATIONS

Seventeen sites were identified at AEDC as having the potential for environmental contamination. These sites have been evaluated and rated using the HARM system which assesses their relative potential for contamination and provides the basis for determining the need for additional IRP investigations. Twelve of the 17 sites have sufficient potential to create environmental contamination and warrant further action in the IRP. The sites evaluated have been reviewed concerning land use restrictions which may be applicable.

RECOMMENDED PHASE II MONITORING

The subsequent recommendations are made to further assess the potential for environmental contamination from waste disposal areas at AEDC. The recommended actions are sampling and monitoring programs to determine if contamination does exist at the site, or in the case of Landfill No. 2/Leaching Pit No. 2 and the Retention Reservoir the extent of contaminant migration. If contamination is identified in this first-step investigation, the Phase II sampling program will probably need to be expanded to define the extent and type of contamination. For example, if contamination is found in the uppermost aquifer from the monitoring wells, then deeper wells will need to be installed to assess the possible penetration of the Manchester aquifer. Also, more extensive analyses may be needed if the parameters recommended herein show positive results.

The determination of the location and depth of new ground-water monitoring wells at AEDC may be difficult due to four major hydrogeologic concerns. These concerns are: (1) the presence of both the shallow aquifer and the deeper Manchester aquifer, (2) the possible discontinuity of the shallow aquifer where shallow ground water may not be present or where the shallow aquifer and Manchester aquifer may be

interconnected, (3) the undocumented and variable ground-water flow directions in both aquifers and (4) the dewatering of both aquifers in the vicinity of the J-4 and Mark I test cells. A carefully planned drilling program and continual evaluation of the hydrogeologic data obtained is recommended for Phase II. Surface geophysical surveys are also recommended to aid in the location of potential waste sources, contamination plume mapping and aquifer delineations. The recommended monitoring program is summarized in Table 6.1 and subsequently discussed. Geophysical surveys, consisting of electrical resistivity, electromagnetic and/or magnetometer techniques, are recommended prior to the well installations to attempt to delineate the horizontal and vertical extent of the site as well as any subsurface leachate plumes migrating from the site. Preliminary checks should be made to determine the effectiveness of geophysics prior to a complete site survey. Following the geophysical surveys ground-water monitoring wells will be installed and sampled. During the well installation, readings with an organic vapor analyzer or similar equipment should be made.

Landfill No. 2/Leaching Pit No. 2 (Site No. 1)

It is recommended that a geophysical survey be conducted at this site to define the extent of the contamination plumes and to evaluate the effectiveness of the existing shallow ground-water monitoring system. New wells should be added as necessary to define the horizontal extent of the contamination plume. If potential contamination of the Manchester aquifer has occurred, four deep monitoring wells should be installed (one upgradient and three downgradient) to determine the extent of vertical migration of contaminants.

This facility has several monitoring wells already installed. It is recommended the existing and any new wells be sampled and analyzed for total organic halogens in addition to those parameters already being tested (see Appendix D for the parameters being analyzed now). The data obtained during the above activities should be continually evaluated to enable concurrent development of a remedial action plan for the site.

Retention Reservoir/J-4 Area Surface Drainage (Site No. 2)

The initial step in the recommended program for assessing the reservoir area is a series of bottom sediment analyses (Table 6.2). The samples should be taken at the sediment surface. A sample would also be

TABLE 6.1
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
1	Landfill No. 2/Leaching Pit No. 2 (80)	Perform a geophysical survey to define potential contamination plumes and to evaluate the effectiveness of the existing ground-water monitoring system. If survey indicates potential contamination in the Manchester aquifer, install monitoring wells into the deeper aquifer to confirm the geophysical data. For the existing monitoring wells, run total organic halogens along with other parameters currently evaluated.
2	Retention Reservoir/ J-4 Surface Drainage (79)	Obtain five samples at the surface of the bottom sediment in the reservoir, one sediment sample in the J-4 drainage channel and one background sample. Analyze the samples for the parameters in List A, Table 6.2.
3	Landfill No. 4 (78)	Perform a geophysical survey to locate major areas of drum disposal and to also define potential contamination plumes. Using the geophysical data locate and install four additional monitoring wells suitably located with one hydrogeologically upgradient of the site and the others downgradient. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List B, Table 6.2.
4	Surface Drainage - Bradley (73)	Obtain five sediment samples in Ditch H and its tributary from the Model Shop. Obtain one background sample. Space the drainage channel samples uniformly from First Street to the Access Highway. Analyze the samples for the parameters in List A, Table 6.2.

TABLE 6.1 (Continued)
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
5	Surface Drainage - Rollins (71)	Obtain six sediment samples in the Rollins channel and one background sample. Space five drainage channel samples uniformly from downstream of the Chemical Treatment Pond to about one mile south of the Access Highway. Obtain one sample in the channel upstream of the Retention Pond diversion structure. Analyze the samples for the parameters in List A, Table 6.2.
6	Camp Forrest Water Treatment Plant (70)	Install one upgradient and three downgradient monitoring wells. Perform a geophysical survey to enable effective location of the monitoring wells. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List C, Table 6.2.
7	Testing Areas (70)	Measure ground-water levels and obtain samples in existing piezometers at AEDC and then use that data to locate additional monitoring wells if needed around the testing area. Install one well hydrogeologically upgradient from the testing area. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List D, Table 6.2. Sample barometric sump and dewatering well discharge water from the test cells and analyze for the parameters in List D, Table 6.2.
8	Leaching Pit No. 1 (70)	Obtain one soil boring through the old leaching pit area. Determine the ground-water level and analyze the unsaturated soils for the parameters in List E, Table 6.2. Install one upgradient and two downgradient monitoring wells. Use piezometric data from Testing Area to locate the monitoring

TABLE 6.1 (Continued)
RECOMMENDED MONITORING PROGRAM
FOR PHASE II IRP AT AEDC

Site No.	Site (Rating)	Recommended Monitoring Program*
		wells. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List F, Table 6.2.
9	Surface Drainage - Brumalow (63)	Obtain three sediment samples in the drainage channel and one background sample. Obtain one sample north of the Access Highway and two samples south. Analyze the samples for the parameters in List A, Table 6.2.
10	Fire Protection Training Area No. 2/Burn Area No. 1/Landfill No. 1 (62)	Perform a geophysical survey to obtain preliminary data of the subsurface disposal site conditions. Using the geophysical survey data, locate five monitoring wells at the site with one upgradient and four downgradient. Construct wells with Schedule 40 PVC and screen 10 to 20 feet into the uppermost aquifer. Sample and analyze water for the parameters in List G, Table 6.2.
11	Chemical Treatment Pond (62)	Obtain two bottom sediment samples and one background sample. Analyze the samples for the parameters in List H, Table 6.2.
12	Retention Leach/Burn Area (62)	Obtain samples at the surface and at four feet depth at the leach/burn site. Obtain one background sample. Analyze the samples for the parameters in List H, Table 6.2.

* If contamination is found in the uppermost aquifer from the recommended monitoring wells, deeper wells penetrating the Manchester aquifer should be installed to assess the extent of movement to the deeper zone.

taken in the J-4 drainage channel along with a background sample. If contamination is confirmed by these initial investigations, more extensive study will be required to assess the movement of pollutants from the reservoir bottom into the uppermost aquifer and possibly the Manchester aquifer. This will necessitate placing several wells near the reservoir and possibly obtaining deeper reservoir sediment samples.

Landfill No. 4 (Site No. 3)

A geophysical survey should be performed to locate major drum disposal areas at Landfill No. 4 and to identify the subsurface conditions. Data from this survey will be used to locate and install four monitoring wells (one upgradient and three downgradient) to supplement the existing wells on site (Table 6.1). Water samples should be analyzed as outlined in Table 6.2.

Surface Drainage - Bradley, Rollins and Brumalow (Site Nos. 4, 5, and 9)

It is recommended that a series of soil samples be obtained at key locations along these drainage channels leading away from the AEDC site. For Bradley and Brumalow drainage channels, samples should also be obtained in the existing skimming ponds and immediately adjacent to the ponds where dredged material has been placed. Table 6.1 outlines the number and general location for the sampling. Table 6.2 lists the parameters to be analyzed for the soil samples. A background sample adjacent to but not in each channel should be obtained for evaluation purposes. If contamination is indicated from this sampling program, the investigation will need to be expanded to determine the extent of potential movement of pollutants into the underlying uppermost aquifer. This may entail additional soil sampling or installation of monitoring wells.

Camp Forrest Water Treatment Plant (Site No. 6)

It is recommended that a geophysical survey be conducted at the Camp Forrest Water Treatment Plant Site to determine the location of buried materials and other subsurface conditions. The data from this survey can be used to effectively locate monitoring wells at the site (Table 6.1). As with the other ground-water monitoring programs for the AEDC disposal sites, if the uppermost aquifer wells reveal contamination, more extensive investigations including deep monitoring wells into the Manchester aquifer will be necessary.

TABLE 6.2
RECOMMENDED LIST OF ANALYTICAL PARAMETERS FOR PHASE II

List A (Site Nos. 2, 4, 5, 9)

Oil and Grease
Volatile Hydrocarbons
Total Organic Halogens
PCB's
Chromium
Iron
Phenols
Zinc
Barium

List B (Site No. 3)

pH
Specific Conductance
Total Organic Carbon
Total Organic Halogens
Chromium
Lead
Barium

List C (Site No. 6)

pH
Specific Conductance
Total Organic Carbon
Total Organic Halogens
Oil and Grease

List D (Site No. 7)

Oil and Grease
Volatile Hydrocarbons
Total Organic Halogens
PCB's
Mercury
Beryllium
Chromium
Iron
Phenols
Zinc
Barium

List E (Site No. 8 - Soil)

Iron
Chromium
Zinc
Barium
Phenols

List F (Site No. 8 - Water)

pH
Specific Conductance
Chloride
Iron
Chromium
Zinc
Barium
Phenols
Total Organic Carbon

List G (Site No. 10)

pH
Specific Conductance
Total Organic Carbon
Total Organic Halogens
Oil and Grease
Phenols
Iron

List H (Site Nos. 11 and 12)

Volatile Hydrocarbons
Total Organic Halogens

Testing Areas (Site No. 7)

For assessing ground-water contamination from the testing areas, it is recommended that the water levels of the existing piezometers around the AEDC plant area (see Section 3) be measured to establish the ground-water flow direction. Also, water samples should be obtained from the dewatering wells (J-4 and Mark I), existing piezometers and barometric sumps in the Test Areas and analyzed for the parameters in Table 6.2. These data can be utilized to locate and install any necessary new upgradient and downgradient monitoring wells for the uppermost aquifer at the site (Table 6.1). New deep monitoring wells into the Manchester aquifer may be required if contamination is indicated in this initial Phase II investigation.

Leaching Pit No. 1 (Site No. 8)

This pit is now filled in near the Model Shop. One soil boring is recommended to be taken through the old leaching pit. The ground-water level should be measured and the soil samples in the unsaturated zone analyzed (Table 6.2) to assess the depth of the leaching area. Three wells are also proposed (one upgradient and two downgradient) for assessing contamination from this site. The piezometric data developed for the Testing Area evaluations may be used for locating the wells.

Fire Protection Training Area No. 2/Burn Area No. 1/Landfill No. 1 (Site No. 10)

A geophysical survey is recommended to delineate the various disposal areas on this site. The geophysical data will also be used to effectively locate one upgradient and four downgradient monitoring wells (Table 6.1). The results of the water analyses (Table 6.2) for this site may need to be expanded based upon the results found in the initial monitoring.

Chemical Treatment Pond (Site No. 11)

At this facility it is recommended that two bottom sediment samples be obtained from the Chemical Treatment Pond plus one background sample adjacent to the pond. More extensive analytical testing may be required if the initial tests (Table 6.2) indicate contamination. In addition, the extent of movement of any contaminants to the uppermost and Manchester aquifers may need to be determined by monitoring wells.

Retention Leach/Burn Area (Site No. 12)

It is recommended that soil samples at the surface and at the four feet depth be obtained at the leach/burn area. A background soil sample from a nearby location is also required. If the results of these initial samples indicate contamination, more extensive evaluations will need to be undertaken as a part of Phase II.

RECOMMENDED GUIDELINES FOR LAND USE RESTRICTIONS

It is desirable to have land use restrictions for the identified sites to (1) provide continued protection of human health, welfare, and environment, (2) insure that migration of potential contaminants is not promoted through improper land uses, (3) facilitate compatible development of future USAF facilities and (4) allow identification of property which may be proposed for excess or outlease.

The recommended guidelines for land use restrictions at each identified disposal site at AEDC are presented in Table 6.3. A description of the land use restriction guidelines is included in Table 6.4. Land use restrictions at sites recommended for on-site monitoring should be re-evaluated upon completion of the Phase II program and appropriate changes made.

TABLE 6.3

Recommended Guidelines at Potential Contamination Sites For Land Use Restrictions

AEDC

Site No.	Site	Recommended Guidelines for Future Land Use Restrictions (1)											
		Construction on the site	Excavation	Well construction on or near site	Agricultural use	Silvicultural use	Water infiltration (Run-on, ponding irrigation)	Recreational use	Burning or ignition source	Disposal operations	Vehicular traffic	Material storage	Housing on or near the site
1	Landfill No. 2/Leaching Pit No. 2	R	R	R	R	R	R	NR	NR	R (2)	NR	NR (3)	R
2	RetentionReservoir/J-4 Area Surface Drainage	NR	NR	R	NA	NA	NA	R	NA	NA	NA	NA	R
3	Landfill No. 4	R	R	R	NR	R	R	NR	NR	R (2)	NR	NR (3)	R
4	Surface Drainage - Bradley	NR	NR	R	NR	NA	NA	NR	NR	NA	NR	NA	R
5	Surface Drainage -Rollins	NR	NR	R	NR	NA	NA	NR	NR	NA	NR	NA	R
6	Camp Forrest Water Treatment Plant	R	R	R	NR	R	R	NR	NR	R (2)	NR	NR (3)	R
7	Testing Areas	NR	NR	R	NR	R	R	NR	NR	R (2)	NR	NR	R
8	Leaching Pit No. 1	NR	NR	R	R	R	R	NR	NR	R (2)	NR	NR (3)	R
9	Surface Drainage - Brumalow	NR	NR	R	NR	NA	NA	NR	NR	NA	NR	NA	R
10	Fire Protection Training Area No. 2/Burn Area No. 1/ Landfill No. 1	R	R	R	NR	R	R	NR	NR	R (2)	NR	NR (3)	R
11	Chemical Treatment Pond	NR	NR	R	NA	NA	NA	R	NA	NA	NA	NA	R
12	Retention Leach/Burn Area	NR	NR	R	NR	R	R	NR	NR	R (2)	NR	NR (3)	R

(1) See Table 6.4 for description of guidelines.
Note the following symbols in this table:
R =Restrict the use of the site for this purpose.
NR = No restriction of the site for this purpose.
NA = Not applicable.

(2)Restrict for all wastes except for construction/demolition debris.

(3) No restriction on solid materials but liquids undesirable.

Source: Engineering-Science

TABLE 6.4
DESCRIPTION OF GUIDELINES FOR LAND USE RESTRICTIONS

Guideline	Description
Construction on the site	Restrict the construction of structures which make permanent (or semi-permanent) and exclusive use of a portion of the site's surface.
Excavation	Restrict the disturbance of the cover or subsurface materials.
Well construction on or near the site	Restrict the placement of any wells (except for monitoring purposes) on or within a reasonably safe distance of the site. This distance will vary from site to site, based on prevailing soil conditions and ground-water flow.
Agricultural use	Restrict the use of the site for agricultural purposes to prevent food chain contamination.
Silvicultural use	Restrict the use of the site for silvicultural uses (root structures could disturb cover or subsurface materials).
Water infiltration	Restrict water run-on, ponding and/or irrigation of the site. Water infiltration could produce contaminated leachate.
Recreational use	Restrict the use of the site for recreational purposes.
Burning or ignition sources	Restrict any and all unnecessary sources of ignition, due to the possible presence of flammable compounds.
Disposal operations	Restrict the use of the site for waste disposal operations, whether above or below ground.
Vehicular traffic	Restrict the passage of unnecessary vehicular traffic on the site due to the presence of explosive material(s) and/or of an unstable surface.
Material storage	Restrict the storage of any and all liquid or solid materials on the site.
Housing on or near the site	Restrict the use of housing structures on or within a reasonably safe distance of the site.

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APPENDIX A

BIOGRAPHICAL DATA

Biographical Data

ROBERT L. THOEM
PII Redacted
Civil/Environmental Engineer

[redacted]

Education

B.S. Civil Engineering, 1962, Iowa State University, Ames, IA
M.S. Sanitary Engineering, 1967, Rutgers University, New Brunswick, NJ

Professional Affiliations

Registered Professional Engineer in six states
American Academy of Environmental Engineering (Diplomate)
American Society of Civil Engineers (Fellow)
National Society of Professional Engineers (Member)
Water Pollution Control Federation (Member)

Honorary Affiliations

Who's Who in Engineering
Who's Who in the Midwest
USPHS Traineeship

Experience Record

1962-1965 U.S. Public Health Service, New York, NY. Staff Engineer, Construction Grants Section (1962-1964). Technical and administrative management of grants for municipal wastewater facilities.

Water Resources Section Chief (1964-1965). Supervised preparation of regional water supply and pollution control reports.

1966-1983 Stanley Consultants, Muscatine, IA and Atlanta, GA. Project Manager and Project Engineer (1966-1973). Responsible for managing studies and preparing reports for a variety of industrial and governmental environmental projects.

Environmental Engineering Department Head (1973-1976). Supervised staff involved in auditing environmental practices, conducting studies and preparing reports concerning water and wastewater systems, solid waste and resource recovery and water resources projects (industrial and governmental).

Robert L. Thoem (Continued)

Resource Management Department Head (1976-1982). Responsible for multidiscipline staff engaged in planning and design of water and wastewater systems, solid waste and resource recovery, water resources, bridge, site development and recreational projects (industrial, domestic and foreign governments).

Associate Chief Environmental Engineer (1980-1983). Corporate-wide quality assurance responsibilities on environmental engineering planning projects.

Operations Group Head and Branch Office Manager (1982-1983). Directed multidiscipline staff responsible for planning and design of steam generation, utilities, bridge, water and wastewater systems, solid waste and resource recovery, water resources, site development and recreational projects (industrial, domestic and foreign governments). Administered branch office support activities.

Project Manager/Engineer for over 25 industrial projects, 25 city and county projects ranging in present study area population from 1,400 to 1,700,000, 10 regional (multi-county) planning or operating agency projects, five state agency projects, 10 projects for federal agencies, and several projects for Middle East governments.

1983-Date Engineering-Science. Senior Project Manager. Responsible for managing a variety of environmental projects. Conducted hazardous waste investigations at seven U.S. Air Force installations to identify the potential migration of contaminants resulting from past disposal practices under the Phase I Installation Restoration Program. Evaluated solid waste collection, disposal and potential for resource recovery at a U. S. Army post. Process selection and preliminary design studies and reports for expanding a municipal advanced wastewater treatment plant from 36 mgd to 54 mgd.

Publications and Presentations

Over thirteen presentations and/or papers in technical publications dealing with solid waste, sludge, water, wastewater and project cost evaluations.

Biographical Data

H. DAN HARMAN, JR.
Hydrogeologist

PII Redacted

[redacted]

Education

B.S., Geology, 1970, University of Tennessee, Knoxville, TN

Professional Affiliations

Registered Professional Geologist (Georgia NO.569)
National Water Well Association (Certified Water Well Driller No. 2664)
Georgia Ground-Water Association

Experience Record

1975-1977 Northwest Florida Water Management District, Havana, Florida. Hydrogeologist. Responsible for borehole geophysical logger operation and log interpretation. Also reviewed permit applications for new water wells.

1977-1978 Dixie Well Boring Company, Inc., LaGrange, Georgia. Hydrogeologist/Well Driller. Responsible for borehole geophysical logger operation and log interpretation. Also conducted earth resistivity surveys in Georgia and Alabama Piedmont Provinces for locations of water-bearing fractures. Additional responsibilities included drilling with mud and air rotary drilling rigs as well as bucket auger rigs.

1978-1980 Law Engineering Testing Company, Inc., Marietta, Georgia. Hydrogeologist. Responsible for ground-water resource evaluations and hydrogeological field operations for government and industrial clients. A major responsibility was as the Mississippi Field Hydrologist during the installation of both fresh and saline water wells for a regional aquifer evaluation related to the possible storage of high level radio-active waste in the Gulf Coast Salt Domes.

1980-1982 Ecology and Environment, Inc., Decatur, Georgia. Hydrogeologist. Responsible for project management of hydrogeological and geophysical investigations at uncontrolled hazardous waste sites. Also prepared Emergency Action Plans and Remedial Approach Plans for U.S. Environmental Protection Agency. Additional

responsibilities included use of the MITRE hazardous ranking system to rank sites on the National Superfund List.

1982-1983 NUS Corporation, Tucker, Georgia. Hydrogeologist. Responsible for project management of hydrogeological and geophysical investigations at uncontrolled hazardous waste sites.

1983-Date Engineering-Science, Inc., Atlanta, Georgia. Hydrogeologist. Responsible for hydrogeological as well as geophysical evaluations at hazardous waste sites.

Publications and Presentations

"Geophysical Well Logging: An Aid in Georgia Ground-Water Projects," 1977, coauthor: D. Watson, The Georgia Operator, Georgia Water and Pollution Control Association.

"Use of Surface Geophysical Methods Prior to Monitor Well Drilling," 1981. Presented to Fifth Southeastern Ground-Water Conference, Americus, Georgia.

"Cost-Effective Preliminary Leachate Monitoring at an Uncontrolled Hazardous Waste Site," 1982, coauthor: S. Hitchcock. Presented to Third National Conference on Management of Uncontrolled Hazardous Waste Sites, Washington, D.C.

"Application of Geophysical Techniques as a Site Screening Procedure at Hazardous Waste Sites," 1983, coauthor: S. Hitchcock. Proceedings of the Third National Symposion and Exposition on Aquifer Restoration and Ground-Water Monitoring, Columbus, Ohio.

"Developing Ground-Water Supplies on the Georgia Piedmont: Applied Technology Versus the 'Dry Hole' Syndrome," 1983, coauthors: D. Watson and T. Duffey. Presentation at the Water Resources of Georgia and Adjacent Areas Conference, Atlanta, Georgia.

"Georgia's Piedmont Ground Water: Proper Well Location is Crucial to Effective Management," 1983, coauthors: D. Watson and T. Duffey. Presentation at National Water Well Association Eastern Regional Conference on Ground-Water Management, Orlando, Florida.

Biographical Data

THOMAS R. HARPER
Chemist

PII Redacted

[redacted]

Education

B.S. in Chemistry, 1983, Ohio State University, Columbus, OH
B.S. in Microbiology, 1983, Ohio State University, Columbus, OH

Professional Affiliations

American Chemical Society

Experience Record

Summers 1980-1981	Reliance Electric Company, Stone Mountain, Georgia - Test Technician. Performed quality assurance testing on instrumentation and wiring on control panels. Performed stress and performance testing and some troubleshooting on programmable controllers.
1983-Date	Engineering-Science, Inc., Atlanta, Georgia - Analytical Chemist. Laboratory activities included analytical work involving samples from industrial/environmental clients. Analyses for priority pollutants, heavy metals, and organic compounds on samples including soils, sludges, water, and wastewater has been done in the laboratory. Analytical instrumentation includes atomic absorption and TOC. Experience includes work with gas and liquid chromatography, infrared and nuclear magnetic resonance spectroscopy. Field work includes sampling of sludges and waste water, assisting staff geologist in aquifer pump testing and geophysical resistivity work in determining possible sources of contamination. Data search and observations for potential environmental problems has also been performed. Typical industrial clients for whom analyses have been performed include: Searle, Merck, U.S. Air Force, General Battery and FMC.

APPENDIX B

LIST OF INTERVIEWEES AND OUTSIDE AGENCY CONTACTS

APPENDIX B

TABLE B.1
LIST OF INTERVIEWEES

	Most Recent Position	Years of Service at AEDC
1.	Administrative Assistant	6
2.	Craft Supervisor	27
3.	Craft Supervisor	26
4.	Temporary Supervisor	12
5.	Craft Supervisor	23
6.	Craft Supervisor	28
7.	Assistant Section Supervisor	18
8.	Technical Assistant	3
9.	First Line Supervisor	30
10.	Section Supervisor	23
11.	Maintenance Engineer	4
12.	Corrosion Control Engineer	6
13.	Environmental Engineer	4
14.	Industrial Hygenist	3
15.	Fuels Supervisor	25
16.	Superintendent Fuels Management	1
17.	Environmental Engineer	4
18.	Supervisor of Cleaning Section	30
19.	Heat Treat and Plater	30
20.	Superintendent of Roads and Grounds	32
21.	Storage Supervisor	32
22.	Supervisor of Chemical Laboratory	23
23.	Crew Chief	32
24.	Manager of Safety Department	26

APPENDIX B

TABLE B.1
(Continued)

LIST OF INTERVIEWEES

	Most Recent Position	Years of Service at AEDC
25.	Asst. Chief of Operations, Fire Department	21
26.	Fire Chief	32
27.	Senior Facility Engineer	19
28.	Road and Grounds Foreman	18
29.	Associate Engineer	22
30.	Historian	2
31.	Manager of Safety, Calspan	15
32.	Senior Facility Engineer	31

TABLE B.2

OUTSIDE AGENCY CONTACTS

Ron Stewart Equipment Operator/ Landfill Supervisor	Coffee Co.-Manchester-Tullahoma Landfill Manchester, TN
Judy Cooper Environmental Scientist	UTSI, AEDC (615) 455-0631
Dewey Vincent Manager	Physical Plant, UTSI, AEDC (615) 455-0631
Publication Clerk	Tennessee Department of Conservation Division of Geology 701 Broadway Nashville, TN 37203 (615) 742-6707
Gary Pinkerton Geologic Aide II	Tennessee Department of Conservation Division of Geology 701 Broadway Nashville, TN 37203 (615) 742-6707
Norman Travis Chemist	Tennessee Department of Public Health Division of Solid Waste Management 150 9th Avenue North Nashville, TN (615) 741-3424
Don Rima Chief Hydrologist	Tennessee Department of Public Health Division of Water Quality Control 150 9th Avenue North Nashville, TN (615) 741-3424
Ed Best Librarian	Tennessee Valley Authority East Tower 2nd Floor Knoxville, TN (615) 632-3464
Archie Whitehead AEDC Wildlife Area Manager	Tennessee Wildlife Resources Agency Route 2 Box 259 Hillsborough, TN (615) 967-6101

TABLE B.2
(Continued)
OUTSIDE AGENCY CONTACTS

Tom Grelen Biologist	Tennessee Wildlife Resources Agency Ellington Agricultural Center Nashville, TN (615) 360-0622
Art Linton Federal Facilities Coordinator	U.S. Environmental Protection Agency 345 Courtland Street, NE Atlanta, Georgia 30365
Paul Russell Soil Conservationist	U.S. Department of Agriculture Soil Conservation Service Manchester, TN (615) 728-2483
Publication Clerk	U.S. Department of Commerce National Oceanic and Atmospheric Administration National Climatic Data Center Asheville, NC 28801 (704) 259-0682
Doug Bradley Flood Plain Management Coordinator	U.S. Department of Defense Corps of Engineers Federal Courthouse Nashville, TN (615) 251-5455
Brad Loar Tennessee Coordinator	U.S. Department of Housing and Urban Development Federal Emergency Management Agency Atlanta, Georgia (404) 881-2391
Kay Johnson Biologist	U.S. Fish and Wildlife Service 1720 West End Nashville, TN (615) 251-5506
Pat Hollyday	U.S. Geological Survey Water Resources Division Federal Courthouse Nashville, TN (615) 251-5424

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

APPENDIX C

TENANT ORGANIZATIONS AND MISSIONS

The following is a listing of the tenant organizations at Arnold Engineering Development Center along with their respective missions.

Communications Detachment, 1973-1 (AFCS)

This squadron provides common-user base communications, intrabase radio support, and navigational aids for AEDC. They also provide advisory service for specified Air National Guard Units.

Tennessee Space Institute (TSI)

The University of Tennessee Space Institute is part of the Graduate School of the University of Tennessee, Knoxville. Their academic program and educational policies support graduate studies and research leading to the degrees of Master of Science and Doctor of Philosophy in selected areas of engineering, mathematics and physical science.

Other Arnold Tenant Organizations

AAFES

AEDC Area Engineer, Mobile District, Corps of Engineers

AFCOMS, OL-HB/FCS

Defense Contract Administration Office (DCASR-Atlanta)

Defense Contract Audit Agency

Air Force Office of Special Investigations DET 816 (AFOSI)

Volunteer Girl Scouts

Boy Scouts, Elk River District

U.S. Department of Agricultrue

Tennessee State Game & Fish Commission

Coffee Co. and the Cities of Manchester and Tullahoma

Tullahoma Kiwanis Club

APPENDIX D

SUPPLEMENTAL BASE FINDINGS INFORMATION

D.1

PESTICIDES CURRENTLY USED AT AEDC

Herbicides/Fungicides	Insecticides	Rodenticides
Acti-dione Thiran	Chloradane 8EC	Diphacin 110
Acti-dione TFG	Diazinon 2D	Strychnine[(1)]
Ammate[(1)]	Diazinon 4E[(1)(2)]	Warfarin[(1)]
AT 711	Flit MLO[(1)]	
Amine 2-4D[(1)]	Insecticide III 8868[(1)]	
Daconil 2787[(1)]	Malathion[(1)(2)]	
Dacthal W75	Methylcarmabate	
Dowpon	Oftanol[(1)]	
Koban[(1)]	Proxol 80 SP[(1)]	
Kromad[(1)]	Pyrethrin &	
Methar 30 (DSMA)	Piperonyl Butoxide[(1)]	
Monosodium (MSMA)[(1)]	Pyrethrin, Piperonyl,	
Paraquat CL[(1)]	Butoxide and Bagon[(1)(2)]	
Pramitol - 5PS[(1)]	Sevin 50W	
Princep 80W[(1)]		
Pre-San[(1)]		
Ronstar G[(1)]		
Roundup[(1)]		
Scotts - 8470[(1)]		
Scotts - 84F3		
Scotts - 8714[(1)]		
Sencor 50% WP[(1)]		
Tersan		
Trex-San		

(1) Mixed and used at the Center.

(2) Mixed off premises and used at Center.

Source: AEDC files.

D.2
PESTICIDES USED AT AEDC IN 1974
AND ON TVA ELECTRICAL TRANSMISSION CORRIDORS
FROM 1952 - PRESENT

Pesticides Used in 1974 at AEDC	Pesticides Used on TVA Electrical Transmission Corridors (1952-Present)
Lethane	2,4-D
Malathion	2,4,5-T
Piperonyl Butoxide and Pyrethrins (Fog Concentrate)	
Diazinon 4E	
Wafarin	
Chlordane	
Flit - MLO	

Source: AEDC files.

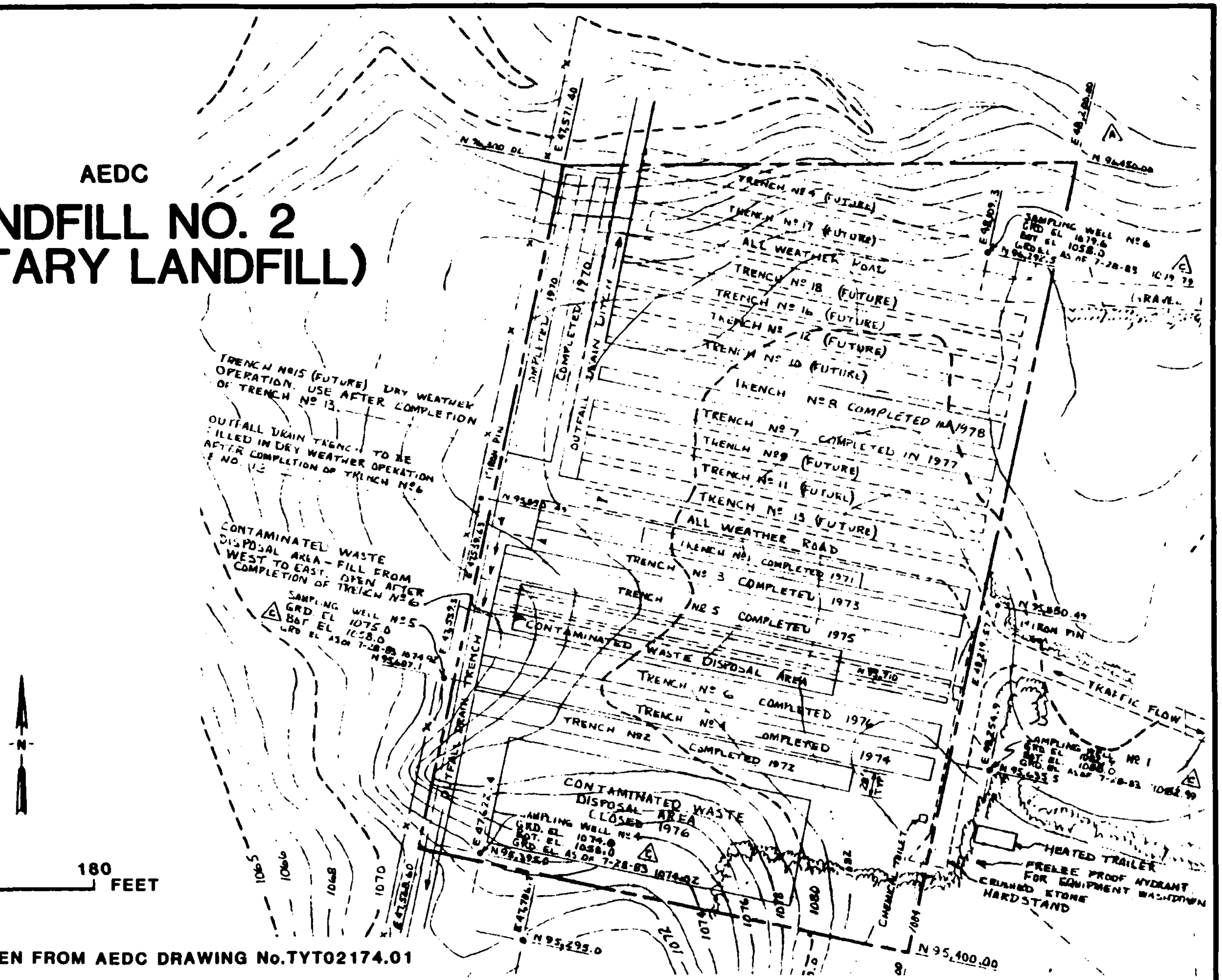
D.3

LANDFILL NO. 2 DRAWING

FROM AEDC FILES

AEDC

LANDFILL NO. 2 (SANITARY LANDFILL)



SCALE 0 180 FEET

SOURCE: TAKEN FROM AEDC DRAWING No.TYT02174.01

D.4

SUMMARY OF KNOWN WASTES DISPOSED
IN LANDFILL NO. 2 FROM 1956
TO 1975 - FROM AEDC FILES

EH, 3, 2, 3

ARO

...ARCH ...NIZATION

INC Subsidiary of Sverdrup & Parcel and Associates, Inc. ARNOLD AIR FORCE STATION, TENNESSEE 37389

May 9, 1975

ARO-75-306

Contracting Officer (PMD)
Arnold Engineering Development Center
Arnold Air Force Station, Tennessee

In Reference To: Letter No. 5-402

Dear Sir:

SUBJECT: Contaminated Waste Disposal Areas

As requested in referenced letter, a chronological history showing the approximate quantities of materials disposed in the contaminated waste disposal area is attached.

This information was compiled from existing logs, operational records, engineering estimates, and extensive interviews with responsible operational and support personnel.

Sincerely,

E. M. Dougherty
President

Atch

(6)

CONTAMINATED WASTE DISPOSAL AREA

AIR FORCE FORMAL LETTER NO. 5-482

May 5, 1975

MATERIAL DISPOSAL HISTORY
(Prepared By R.W.S., TSD-BGE)

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1956	Electronic tubes, mercury vapor lamps, etc.	12 ea.	1071
	Fluorescent tubes, 48" x 40 W	8,500 ea.	1071
	Hardening salts of Barium, Calcium, & Sodium Chloride	1200 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
	Varsol and Paint	50 gals.	1072
1957	Electronic tubes, mercury vapor lamps, etc.	18 ea.	1071
	Fluorescent tubes	9,000 ea.	1071
	Beryllium with rags, clothing, etc.	less than .2 #	1071
	Varsol and paint	50 gals.	1071
1958	Electronic tubes, etc.	20 ea.	1071
	Fluorescent tubes	9,500 ea.	1071
	5% Trisodium Phosphate & 10% Caustic Soda	800 gals.	1073
	40% Nitric and 5% Hydrofluoric Acid	800 gals.	1073
	10% Hydrochloric Acid and 5% Caustic Soda	800 gals.	1073
	Transformer oil soaked filter paper and fullers earth	200 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
	Varsol and paint	55 gals.	1072

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1959	Electronic tubes, etc.	24 ea.	1071
	Fluorescent tubes	9,500 ea.	1071
	Transformer oil soaked filter paper & fullers earth	220 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
	Varsol and paint	50 gals.	1072
	High energy fuel - 2 with piping, equip., containers, etc.	less than 1 gal.	1072
1960	Electronic tubes, etc.	28 ea.	1071
	Fluorescent tubes	10,500 ea.	1071
	Transformer oil soaked filter paper & fullers earth	225 #	1072
	Varsol and paint	100 gals.	1072
	5% Trisodium Phosphate & 10% Caustic Soda	800 gals.	1072
	40% Nitric & 5% Hydrofluoric Acid	800 Gals.	1072
	"Black Magic" coating (Sodium Hydroxide with traces of Iron, Aluminum, Silicon, and Boron)	1600 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
1961	Electronic tubes, etc.	32 ea.	1071
	Fluorescent tubes	11,500 ea.	1071
	Transformer oil soaked filter paper & fullers earth	235 #	1072
	Varsol and paint	100 gals.	1072
	Naptha and paint	50 gals.	1072
	5% Trisodium Phosphate & 10% Caustic Soda	1,200 gals.	1072
	40% Nitric & 5% Hydrofluoric Acid	1,200 gals.	1072
	10% inhibited Hydrochloric Acid	50 gals.	1072
	Hardening salts of Barium, Calcium, & Sodium Chloride	1200 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
1962	Electronic tubes, etc.	40 ea.	1071
	Fluorescent tubes	12,000 ea.	1071
	Transformer oil soaked filter paper & fullers earth	240 #	1072
	Varsol and paint	110 gals.	1072
	Naptha and paint	55 gals.	1072
	Tempering salts of Sodium Nitrate & Potasium Nitrate	350 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1963	Electronic tubes, etc.	45 ea.	1071
	Fluorescent tubes	12,500 ea.	1071
	Transformer oil soaked filter paper & fullers earth	250 #	1072
	Varsol and paint	110 gals.	1072
	Naptha and paint	55 gals.	1072
	Acetone and cleaning residue	30 gals.	1072
	"Black Magic" coating	1600 #	1072
	Beryllium with rags, clothing, etc.	less than .2 #	1072
1964	Electronic tubes, etc.	48 ea.	1071
	Fluorescent tubes	12,700 ea.	1071
	Transformer oil soaked filter paper & fullers earth	275 #	1072
	Varsol and paint	110 gals.	1073
	Naptha and paint	55 gals.	1073
	Acetone and cleaning residue	30 gals.	1073
	Beryllium with rags, clothing, etc.	less than .3 #	1073
1965	Electronic tubes, etc.	50 ea.	1072
	Fluorescent tubes	13,500 ea.	1072
	Transformer oil soaked filter paper & fullers earth	300 #	1072
	Varsol and paint	160 gals.	1073
	Naptha and paint	110 gals.	1073
	Acetone and cleaning residue	55 gals.	1073
	Methyl Ethyl Ketone and cleaning residue	40 gals.	1073
	Toulene and cleaning residue	40 gals.	1073
	Beryllium with rags, clothing, etc.	less than .2 #	1072
1966	Electron tubes, etc.	52 ea.	1072
	Fluorescent tubes	13,800 ea.	1072
	Transformer oil soaked filter paper & fullers earth	300 #	1072
	Varsol and paint	160 gals.	1073
	Naptha and paint	110 gals.	1073
	Acetone and cleaning residue	55 gals.	1073
	Methyl Ethyl Keytone and cleaning residue	55 gals.	1073
	Toulene and cleaning residue	55 gals.	1073
	"Black Magic" coating	1600 #	1073
	Beryllium with rags, clothing, etc.	less than .2 #	[illegible]

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1967	Electron tubes, etc.	52 ea.	1072
	Fluorescent tubes	14,300 ea.	1072
	Transformer oil soaked filter paper & fullers earth	310 #	1073
	Varsol and paint	160 gals.	1074
	Naptha and paint	110 gals.	1074
	Acetone and cleaning residue	55 gals.	1074
	Methyl Ethyl Keytone and cleaning residue	55 gals.	1074
	Toulene and cleaning residue	55 gals.	1074
	Hardening salts of Barium, Calcium, & Sodium Chloride	1200 #	1074
	Beryllium with rags, clothing, etc.	less than .2 #	1073
1968	Electron tubes, etc.	55 ea.	1073
	Fluorescent tubes	14,700 ea.	1073
	Transformer oil soaked filter paper & fullers earth	300 #	1073
	Varsol and paint	180 gals.	1074
	Naptha and paint	130 gals.	1074
	Acetone and cleaning residue	50 gals.	1074
	Methyl Ethyl Keytone and cleaning residue	55 gals.	1074
	Toulene and cleaning residue	50 gals.	1074
	Beryllium with rags, clothing, etc.	less than .2 #	1074
1969	Electron tubes, etc.	50 ea.	1073
	Fluorescent tubes	15,500 ea.	1073
	Transformer oil soaked filter paper & fullers earth	320 #	1073
	Varsol and paint	180 gals.	1074
	Naptha and paint	120 gals.	1074
	Acetone and cleaning residue	50 gals.	1074
	Methyl Ethyl Keytone and cleaning residue	50 gals.	1074
	Toulene and cleaning residue	55 gals.	1074
	Beryllium with rags, clothing, etc.	less than .3 #	1074
	Chromic Acid	50 Gals.	1074
	"Black Magic" coating	1600 #	1074

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1970	Electron tubes, etc.	55 ea.	1073
	Fluorescent tubes	15,700 ea.	1073
	Transformer oil soaked filter paper & fullers earth	325 #	1073
	Varsol and paint	160 gals.	1073
	Naptha and paint	100 gals.	1073
	Acetone and cleaning residue	55 gals.	1073
	Methyl Ethyl Keytone and cleaning residue	55 gals.	1073
	Toulene and cleaning residue	50 gals.	1073
	Beryllium with rags, clothing, etc.	less than .7 #	1074
	Chromic Acid	50 gals.	1074
1971	Electron tubes, etc.	50 ea.	1072
	Fluorescent tubes	16,100 ea.	1072
	Transformer oil soaked filter paper and fullers earth	330 #	1072
	Varsol and paint	160 gals.	1073
	Naptha and paint	100 gals.	1073
	Acetone and cleaning residue	50 gals.	1073
	Methyl Ethyl Keytone and cleaning residue	50 gals.	1073
	Toulene and cleaning residue	50 gals.	1073
	2,4,5-T; 2,4-D and containers	less than 1 gal.	1073
	Malathion and containers	less than 1 gal.	1073
	Beryllium with rags, clothing, etc.	less than .9 #	1073
	Chromic Acid	50 gals.	1073
1972	Electron tubes, etc.	52 ea.	1073
	Fluorescent tubes	16,300 ea.	1073
	Transformer oil soaked filter paper & fullers earth	320 #	1073
	Varsol and paint	165 gals.	1073
	Naptha and paint	110 gals.	1073
	Acetone and cleaning residue	50 gals.	1073
	Methyl Ethyl Keytone and cleaning residue	50 gals.	1073
	Toulene and cleaning residue	50 gals.	1073
	2,4,5-T; 2,4-D and containers	less than 1 gal.	1072
	Malathion, Lethane, and containers	less than 1 gal.	1072
	Beryllium with rags, clothing, etc.	less than .7 #	1072
	Tempering salts of Sodium Nitrate & Potasium Nitrate	350 #	1072
	Chromic Acid	50 Gals.	1072

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1973	Electron tubes, etc.	50 ea.	1073
	Fluorescent tubes	16,700 ea.	1073
	Transformer oil soaked filter paper & fullers earth	325 #	1073
	Varsol and paint	165 gals.	1074
	Naptha and paint	110 gals.	1074
	Acetone and cleaning residue	50 gals.	1074
	Methyl Ethyl Keytone and cleaning residue	50 gals.	1074
	Toulene and cleaning residue	50 gals.	1074
	Methyl Chloroform and cleaning residue	110 gals.	1073
	2,4,5-T; 2,4-D and containers	less than 1 gal.	1073
	Malathion, Lethane, and containers	less than 1 gal.	1073
	Beryllium with rags, clothing, etc.	less than 1.2 #	1073
	Chromic Acid	50 gals.	1073
	"Black Magic" coating	1600 #	1073
	40% Nitric & 2% Hydrofluoric Acid (to Leaching Pit)	2,500 gals.	1072
	10% Hydrochloric Acid (to Leaching Pit)	150 gals.	1072
1974	Electron tubes, etc.	54 ea.	1072
	Fluorescent tubes	17, 300 ea.	1072
	Transformer oil soaked filter paper & fullers earth	325 #	1072
	Varsol and paint	160 gals.	1072
	Naptha and paint	100 gals.	1072
	Acetone and cleaning residue	50 gals.	1072
	Methyl Ethyl Keytone and cleaning residue	50 gals.	1072
	Toulene and cleaning residue	50 gals.	1072
	Methyl Chloroform and cleaning residue	110 gals.	1072
	2,4,5-T; 2,4-D and containers	less than 1 gal.	1072
	Malathion, Lethane, and containers	less than 1 gal.	1072
	Beryllium with rags, clothing, etc.	less than 1.2 #	1072
	AZ-50 with contaminated piping	less than 1 #	1072
	Chromic Acid	50 gals.	1076
	40% Nitric & 2% Hydrofluoric Acid (to Leaching Pit)	2,500 gals.	1076
	10% Hydrochloric Acid (to Leaching Pit)	150 gals.	1076
	25% Phosphoric Acid (to Leaching Pit)	200 gals.	1076

YEAR	DESCRIPTION OF DISPOSED WASTE	APPROX. QUANTITY	APPROX. ELEV. FT. ABOVE MSL
1975*	Electron tubes, etc.	18 ea.	1073
	Fluorescent tubes	3,500 ea.	1073
	Transformer oil soaked filter paper & fullers earth	100 #	1073
	Varsol and paint	100 gals.	1073
	Naptha and paint	55 gals.	1073
	Methyl Chloroform and cleaning residue	55 gals.	1073
	Beryllium with rags, clothing, etc.	less than .5 #	1073
	40% Nitric & 2% Hydrofluoric Acid (to Leaching Pit)	2,500 gals.	1076
	Sodium Hydroxide	100 #	1076

* 1 January through 30 April

D.5

LANDFILL NO. 2 GROUND-WATER

MONITORING WELL DATA FROM 1979

TO 1984 - FROM AEDC FILES

AEDC SANITARY LANDFILL WELLS ANALYSES

Well No.	(1) Value	Date Analyzed and By Whom	(2) Value	Date Analyzed and By Whom	(3) Value	Date Analyzed and By Whom	(4) Value	Date Analyzed and By Whom	(5) Value	Date Analyzed and By Whom	(6) Value	Date Analyzed and By Whom	Remarks
pH	7	1/17/79 L.D.A.	7	1/17/79 L.D.A.	7.6	1/17/79 L.D.A.	6.9	1/17/79 L.D.A.	7.2	1/17/79 L.D.A.	7.3	1/17/79 L.D.A.	
Specific Conductance, Mhos	322	1/17/79 L.D.A.	769	1/17/79 L.D.A.	189	1/17/79 L.D.A.	556	1/17/79 L.D.A.	417	1/17/79 L.D.A.	257	1/17/79 L.D.A.	
Hardness, ppm $CaCO_3$	234	24 H.I.	488	24 H.I.	116	24 H.I.	375	24 H.I.	289	24 H.I.	159	24 H.I.	
Alkalinity, ppm $CaCO_3$	167	1/17/79 H.I.	347	1/17/79 H.I.	125	1/17/79 H.I.	375	1/17/79 H.I.	296	1/17/79 H.I.	238	1/17/79 H.I.	
COD	9.72	2/28/79 P.S.B.	47.2	2/28/79 P.S.B.	7.70	2/28/79 P.S.B.	5.05	2/28/79 P.S.B.	4.54	2/28/79 P.S.B.	9.34	2/28/79 P.S.B.	
Solids Dissolved, ppm	225.4	1/17/79 J.C.	661.2	1/17/79 J.C.	136	1/17/79 J.C.	400.4	1/17/79 J.C.	308.6	1/17/79 J.C.	187.6	1/17/79 J.C.	
Solids Suspended, ppm	6.5	1/17/79 J.C.	44.2	1/17/79 J.C.	22.9	1/17/79 J.C.	66	1/17/79 J.C.	24.5	1/17/79 J.C.	595.1	1/17/79 J.C.	
Sulfate, ppm	1.0	1/19/79 H.I.	1.1	1/19/79 H.I.	5	1/19/79 H.I.	5.6	1/19/79 H.I.	5.8	1/19/79 H.I.	0.6	1/19/79 H.I.	
Chloride, ppm	1.2	1/17/79 L.D.A.	11.7	1/17/79 L.D.A.	2.1	1/17/79 L.D.A.	11.2	1/17/79 L.D.A.	3.2	1/17/79 L.D.A.	7.3	1/17/79 L.D.A.	
N-Kheldahl, ppm	<.01	2/12/79 P.S.B.	1.17	2/12/79 P.S.B.	0.18	2/12/79 P.S.B.	0.19	2/12/79 P.S.B.	0.34	2/12/79 P.S.B.	0.44	2/12/79 P.S.B.	
NO_3^--Nitrogen ppm	1.9	1/17/79 P.S.B.	115	1/17/79 P.S.B.	1.7	1/17/79 P.S.B.	1.95	1/17/79 P.S.B.	1.4	1/17/79 P.S.B.	1.85	1/17/79 P.S.B.	
NH_3-N_2m ppm	<.01	1/17/79 P.S.B.	<0.01	1/17/79 P.S.B.	<0.01	1/17/79 P.S.B.	<0.01	1/17/79 P.S.B.	<0.01	1/17/79 P.S.B.	<0.01	1/17/79 P.S.B.	
Iron, ppm	1.1	1/31/79 H.I.	0.2	1/31/79 H.I.	0.3	1/31/79 H.I.	0.2	1/31/79 H.I.	0.2	1/31/79 H.I.	0.14	1/31/79 H.I.	
Manganese, ppm	0.01	1/31/79 H.I.	0.10	1/31/79 H.I.	0.004	1/31/79 H.I.	0.03	1/31/79 H.I.	0.008	1/31/79 H.I.	0.02	1/31/79 H.I.	
Sodium, ppm	1.6	2/1/79 H.I.	7.7	2/1/79 H.I.	1.4	2/1/79 H.I.	4.5	2/1/79 H.I.	3.3	2/1/79 H.I.	3.3	2/1/79 H.I.	
Potassium, ppm	0.5	2/1/79 H.I.	1.2	2/1/79 H.I.	1.9	2/1/79 H.I.	1.3	2/1/79 H.I.	1.3	2/1/79 H.I.	5.7	2/1/79 H.I.	
Chromium, ppm	0.07	1/31/79 H.I.	0.03	1/31/79 H.I.	0.07	1/31/79 H.I.	0.04	1/31/79 H.I.	0.05	1/31/79 H.I.	0.07	1/31/79 H.I.	
Nickel, ppm	0.06	1/31/79 H.I.	0.08	1/31/79 H.I.	N.D.	1/31/79 H.I.	0.02	1/31/79 H.I.	N.D.	1/31/79 H.I.	N.D.	1/31/79 H.I.	
		1/31/79		1/31/79		1/31/79		1/31/79		1/31/79		1/31/79	

AEDC SANITARY LANDFILL WELLS ANALYSES

ell No.	(1) Value	Date Analyzed and By Whom	(2) Value	Date Analyzed and By Whom	(3) Value	Date Analyzed and By Whom	(4) Value	Date Analyzed and By Whom	(5) Value	Date Analyzed and By Whom	(6) Value	Date Analyzed and By Whom	Remarks (Inc
inc, ppm	0.02	1/31/79 H.I.	0.05	1/31/79 H.I.	0.03	1/31/79 H.I.	0.02	1/31/79 H.I.	0.03	1/31/79 H.I.	0.05	1/31/79 H.I.	
opper, ppm	0.01	1/31/79 H.I.	0.02	1/31/79 H.I.	0.003	1/31/79 H.I.	0.02	1/31/79 H.I.	N.D.	1/31/79 H.I.	0.006	1/31/79 H.I.	
lu[illegible]um, ppm	0.2	1/31/79 H.I.		1/31/79 H.I.		1/31/79 H.I.		1/31/79 H.I.		1/31/79 H.I.		1/31/79 H.I.	
OD, ppm								1/31/79 H.I.					
ell Water Level	12' 3"	1/16/79 LDA/JRM	11' 7"	1/16/79 LDA/JRM	3' 3"	1/16/79 LDA/JRM	5' 4"	1/16/79 LDA/JRM	8' 5"	1/16/79 LDA/JRM	9' 4"	1/16/79 LDA/JRM	
O4 reported as - osphorus, ppm	Nil	24 H.I.	Nil	24 H.I.	Nil	24 H.I.	Nil	24 H.I.	Nil	24 H.I.	Nil	24 H.I.	
ate Sampled	1/16/79		1/16/79		1/16/79		1/16/79		1/16/79		1/16/79		
ime Sampled	13:30		13:55		14:10		14:30		14:50		12:45		
mpled By	LDA/JRM		LDA/JRM		LDA/JRM		LDA/JRM		LDA/JRM		LDA/JRM		

Rp 1067.6

Analysis by State Lab

Summary

AEDC SANITARY LANDFILL WELL ANALYSES

Sample Split with State

DATE: 14 Oct 80

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Odor, Bt-Co Units -A						
Color, - A Apparent / True	96 / 5	304 / 14	96 / 5	26 / <3	92 / 14	152 / 19
MBA Substances, mg/l-A	0.05	0.06	<0.03	0.04	0.05	0.05
Endrin, mg/l - A	N.D	N.D.	N.D	N.D	N.D	N.D
Lindane, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
Methoxychlor, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
Toxaphene, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
2, 4-D, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
2,4,5-TP Silvex, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
PCB, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
Phenols, mg/l - A	<0.010	<0.010	<0.010	0.016	<0.010	<0.010
Acetone, mg/l - A	NR	NR	NR	NR	NR	NR
Methylchloroform, mg/l-A	~~NR~~	NR	NR	NR	NR	NR
MEK, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
Toluene, mg/l - A	N.D	0.0229	N.D.	0.0117	0.0051	N.D
Varsol, mg/l - A	NR	NR	NR	NR	NR	NR
Xylene, mg/l - A	N.D	N.D	N.D	N.D	N.D	N.D
1,1,1-trichloroethane	N.D	13,750	0.148	6.020	0.0468	0.015
1,1-dichloroethylene	N.D	☆	N.D.	☆	NR	N.D
trichloroethylene	N.D	41.500	0.048	☆	0.0096	N.D
1,1,2,2-tetrachloroethylene	N.D	29.300	N.D	0.910	0.0965	N.D
Chloroform	N.D	NR	N.D	☆	NR	N.D
methylene chloride	N.D	NR	N.D	4.310	NR	N.D
1,1-dichloroethane	N.D	~~NR~~	0.0129	1.190	0.0125	N.D
Chlordane	N.D	N.D	N.D	N.D	N.D	N.D

The state did these [illegible]

N.D. = none detected NR = not reported ☆ = detected but not quantified

Analysis by State Lab — Summary

AEDC SANITARY LANDFILL WELL ANALYSES

DATE: Sample split with State 14 Oct 80

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A	0.001	0.001	0.002	0.002	<0.001	0.002
Barium (Ba), ppm-A	0.060	0.310	0.070	0.060	0.070	0.050
Beryllium (Be), ppm-A	< 1	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd), ppm-A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chloride, ppm-A	2	5	4	30	10	11
Chromium (Cr), ppm-Q&A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
COD, mg/l Q&A	13	37	14	25	10	6
Conductance, umho/cm-Q&A	465	874	364	705	545	378
Copper, ppm-A	0.139	0.095	0.067	0.103	0.110	0.031
Cyanide, mg/l -Q&A	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
Flouride, mg/l -A	0.33	0.70	0.55	0.66	0.77	0.16
Iron, (Fe), ppm-A	1.2	1.9	80	4.1	2.1	1.4
Kjeldahl-N, mg/l -A	0.2	2.0	0.1	<0.1	<0.1	<0.1
Lead (Pb), ppm-Q&A	0.05	0.04	0.040	0.060	0.080	<0.010
Manganese (Mn), ppm-A	1.4	0.09	0.013	0.047	0.056	0.056
Mercury (Hg), ppb-Q&A	0.5	0.8	<0.2	<0.2	<0.2	<0.2
Nitrate-N, mg/l -A	0.07	20	0.22	0.03	0.05	0.02
pH-Q&A	7.1	6.7	7.1	6.8	7.2	7.1
Selenium (Se), ppb-A	< 1	< 1	< 1	< 1	1	< 1
Silver (Ag) ppm-Q&A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4), ppm-A	4	< 3	< 3	4	4	< 3
Zinc (Zn), ppm-A	0.058	0.058	0.028	0.036	0.050	0.041
Well Water Level, ft.						

AEDC ANITARY LANDFILL WELL ANALYSES

DATE Sampled - 10/14/80

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
nic (As), ppm-A	<0.001	0.003	<0.001	0.002	<0.001	<0.001
um (Ba), ppm-A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
llium (Be), ppm-A	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ium (Cd), ppm-A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ride, ppm-A	1.62	9.18	4.68	31.32	13.32	13.68
mium (Cr), ppm-Q&A	0.03	0.08	0.11	0.08	0.02	0.02
mg/ℓ Q&A	13	41	<5	18	<5	8
uctance, μmho/cm - Q&A	450.5	819.7	339	689.7	512.8	323.6
er, ppm-A	0.33	0.23	0.09	0.24	0.18	0.08
nide, mg/ℓ-Q&A	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
uride, mg/ℓ -A	0.28	0.71	0.52	0.71	0.78	0.22
n, (Fe), ppm-A	1.8	2.1	12.9	6.8	1.3	0.46
dahl-N, mg/ℓ-A	0.69	1.43	0.37	0.39	0.15	0.24
d (Pb), ppm-Q&A	<0.05	0.06	0.03	0.06	0.03	0.05
ganese (Mn), ppm-A	0.02	0.13	0.03	0.07	0.04	0.03
cury (Hg), ppb-Q&A	0.0006	0.0012	<0.0002	0.0003	<0.0002	[illegible]
rate-N, mg/ℓ -A	0.74	29	0.3	1.35	0.83	1.45
Q&A	7.1	6.7	7.4	7.6	7.2	7.3
enium (Se), ppb-A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
ver (Ag) ppm -Q&A	0.06	0.07	0.07	0.03	0.03	0.04
lfate (SO_4), ppm -A	4.2	4.0	3.4	3.0	6.2	1.5
nc (Zn), ppm -A	0.1	0.11	0.06	0.1	0.12	0.05
ll Water Level, ft.	20'	16'	8'	12'	12'	12'

AEDC ANITARY LANDFILL WELL ANALYSES

DATE Sampled - 10/14/80

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
T.O.N., Bt-Co Units -A	2	16	1	16	1	1
r, - A Color Units	4	4	8	4	2	2
Substances, mg/l - A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0
in, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
ane, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
oxychlor, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
phene, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
-D, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.	<1.0
.5-TP Silvex, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
nols, mg/l - A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0
tone, mg/l - A	<0.3	0.6	<0.3	0.9	<0.3	1.4
hylchloroform, mg/l - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
, mg/l - A	<0.4	3.4	<0.4	0.4	2.0	<0.4
uene, mg/l - A	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
sol, mg/l - A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
ene, mg/l - A	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6

REPORT OF ANALYSE'

Division of Water Quality Control ..... Tennessee Department of Public Health

SOURCE: AEDC Landfill Tullahoma Mi: (WELL # 1)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells around landfill

Field Number ______ Collected By SBD NHT Primary Station Number ______ Date Collected 8(?)1014

Time Collected ______ Sample Depth (ft.) ______ Laboratory No. SWM 1178

10-Temperature °C			2	340-C.O.D. mg/L (High Level)		12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	13	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L			14
403-pH, Lab.	✓	7.1	5	412 Alkalinity (Net) mg/L			15
400-pH, Field			6	38260-MBAS mg/L	✓	0.05	16
81-App. Color Pt - Co units	✓	96	7	95-Conductivity Micromho 25 °C	✓	46.5	17
80-True Color Pt - Co units	✓	5	8	1105-Aluminum as Al ug/L			18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓	60	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L			20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L			21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓	<1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L			23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓	<1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L			25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓	<1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓	<10	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L			28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L		0.01	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓	0.07	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L			1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L			2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L			3
635-Total Kjl. Nitrogen as N mg/L	✓	0.2	24	545-Settleable Residue ml/l			4
630-NO_3 & NO_2 as N mg/L		0.08	25	666-Diss. Phosphate as P mg/L			5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L			6
1045-Iron as Fe ug/L	✓	1200	27	746-Sulfide, Dissolved as S mg/L			7
1055-Manganese as Mn ug/L	✓	14	28	369-Cl_2 Demand, 30 min. mg/L			8
940-Chloride as Cl mg/L	✓	2	29	50064-Cl_2, Free Res. mg/L			9
950-Fluoride as F mg/L	✓	0.33	30	50060-Cl_2, Combined Res. mg/L			10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L			11
945-Sulfate as SO_4 mg/L	✓	4	2	550-Oil and Grease mg/L			12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓	<0.02	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L			14
71900-Mercury-Total as Hg ug/L	✓	0.5	5	610-Ammonia Nitrogen as N mg/L			15
1051-Lead as Pb ug/L	✓	50	6	605-Organic Nitrogen as N mg/L			16
1042-Copper as Cu ug/L	✓	139	7	58-Flow Rate CFM			17
1002-Arsenic as As ug/L	✓	1	8	61-Flow Rate CFS, Instantaneous			18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily			19
1092-Zinc as Zn ug/L	✓	58	10	Beryllium	✓	<1	
955-Silica as SiO_2 mg/L			11				

Remarks: ______

PH-054
WQC-6/79

REPORT OF ANALYSES

Division of Water Quality Control — Tennessee Department of Public Health

SOURCE: AEDC Landfill Tullahoma Mile: (WELL #2)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells around landfill

Field Number ______ Collected By SBD. NHT Primary Station Number ______ Date Collected 801014

Time Collected ______ Sample Depth (ft) ______ Laboratory No. SWM 1179

10-Temperature °C			2	340-C.O.D. mg/L (High Level)			12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	37	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L			14
403-pH, Lab.	✓	6.7	5	412 Alkalinity (Net) mg/L			15
400-pH, Field			6	38260-MBAS mg/L	✓	0.06	16
81-App. Color Pt - Co units	✓	304	7	95-Conductivity Micromho 25 °C	✓	824	17
80-True Color Pt - Co units	✓	18	8	1105-Aluminum as Al ug/L			18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓	310	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L			20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L			21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓	<1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L			23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓	<1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L			25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓	<1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓	<10	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L			28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L		1.6	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓	20.	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L			1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L			2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L			3
635-Total Kjl. Nitrogen as N mg/L	✓	2.0	24	545-Settleable Residue ml/l			4
630-NO_3 & NO_2 as N mg/L		22.	25	666-Diss. Phosphate as P mg/L			5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L			6
1045-Iron as Fe ug/L	✓	1900	27	746-Sulfide, Dissolved as S mg/L			7
1055-Manganese as Mn ug/L	✓	92	28	369-Cl_2 Demand, 30 min. mg/L			8
940-Chloride as Cl mg/L	✓	5	29	50064-Cl_2, Free Res. mg/L			9
950-Fluoride as F mg/L	✓	0.70	30	50060-Cl_2, Combined Res. mg/L			10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L			11
945-Sulfate as SO_4 mg/L	✓	43	2	550-Oil and Grease mg/L			12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓	<0.02	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L			14
71900-Mercury-Total as Hg ug/L	✓	0.8	5	610-Ammonia Nitrogen as N mg/L			15
1051-Lead as Pb ug/L	✓	40	6	605-Organic Nitrogen as N mg/L			16
1042-Copper as Cu ug/L	✓	95	7	58-Flow Rate CFM			17
1002-Arsenic as As ug/L	✓	1	8	61-Flow Rate CFS, Instantaneous			18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily			19
1092-Zinc as Zn ug/L	✓	58	10	Beryllium	✓	<1	
955-Silica as SiO_2 mg/L			11				

Remarks ______

PH-0549
WCC-6/79

REPORT OF ANALYSES

Division of Water Quality Control — Tennessee Department of Public Health

SOURCE: AEDC Landfill Tullahoma Mi: (WELL # 3)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells around landfill

Field Number ______ Collected By SBD NHT Primary Station Number ______ Date Collected 801014

Time Collected ______ Sample Depth (ft) ______ Laboratory No. SWM 1180

10-Temperature °C			2	340-C.O.D. mg/L (High Level)			12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	14	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L			14
403-pH, Lab.	✓	7.1	5	412 Alkalinity (Net) mg/L			15
400-pH, Field			6	38260-MBAS mg/L	✓	<0.03	16
81-App. Color Pt - Co units	✓	16	7	95-Conductivity Micromho 25 °C	✓	364	17
80-True Color Pt - Co units	✓	5	8	1105-Aluminum as Al ug/L			18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓	70	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L			20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L			21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓	<1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L			23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓	<1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L			25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓	<1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓	<10	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L			28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L		0.03	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓	0.22	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L			1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L			2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L			3
625-Total Kjl. Nitrogen as N mg/L	✓	0.1	24	545-Settleable Residue ml/L			4
630-NO_3 & NO_2 as N mg/L		0.25	25	666-Diss. Phosphate as P mg/L			5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L			6
1045-Iron as Fe ug/L	✓	8000	27	746-Sulfide, Dissolved as S mg/L			7
1055-Manganese as Mn ug/L	✓	13	28	369-Cl_2 Demand, 30 min. mg/L			8
940-Chloride as Cl mg/L	✓	4	29	50064-Cl_2, Free Res. mg/L			9
950-Fluoride as F mg/L	✓	0.55	30	50060-Cl_2, Combined Res. mg/L			10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L			11
945-Sulfate as SO_4 mg/L	✓	<3	2	550-Oil and Grease mg/L			12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓	<0.02	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L			14
71900-Mercury-Total as Hg ug/L	✓	<0.2	5	610-Ammonia Nitrogen as N mg/L			15
1051-Lead as Pb ug/L	✓	40	6	605-Organic Nitrogen as N mg/L			16
1042-Copper as Cu ug/L	✓	67	7	58-Flow Rate CFM			17
1002-Arsenic as As ug/L	✓	2	8	61-Flow Rate CFS, Instantaneous			18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily			19
1092-Zinc as Zn ug/L	✓	28	10	Beryllium	✓	<1	
955-Silica as SiO_2 mg/L			11				

Remarks ______

PH-0543
WQC-6/79

REPORT OF ANALYSIS

Division of Water Quality Control — Department of Public Health

SOURCE: AEDC Landfill Tullahoma (WELL # 4)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells Around Landfill

Field Number ______ Collected By SED NHT Primary Station Number ______ Date Collected 801014

Time Collected ______ Sample Depth (ft) ______ Laboratory No. SWM 1181

10-Temperature °C			2	340-C.O.D. mg/L (High Level)		12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	25	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L		14
403-pH, Lab.	✓	6.8	5	412 Alkalinity (Net) mg/L		15
400-pH, Field			6	38260-MBAS mg/L	✓ 0.04	16
81-App. Color Pt - Co units	✓	26	7	95-Conductivity Micromho 25 °C	✓ 705	17
80-True Color Pt - Co units	✓	<3	8	1105-Aluminum as Al ug/L		18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓ 60	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L		20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L		21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓ <1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L		23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓ <1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L		25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓ <1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓ 16	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L		28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L	0.02	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓ 0.03	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L		1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L		2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L		3
625-Total Kjl. Nitrogen as N mg/L	✓	<0.1	24	545-Settleable Residue ml/l		4
630-NO_3 & NO_2 as N mg/L		0.05	25	666-Diss. Phosphate as P mg/L		5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L		6
1045-Iron as Fe ug/L	✓	4100	27	746-Sulfide, Dissolved as S mg/L		7
1055-Manganese as Mn ug/L	✓	47	28	369-Cl2 Demand, 30 min. mg/L		8
940-Chloride as Cl mg/L	✓	30	29	50064-Cl_2, Free Res. mg/L		9
950-Fluoride as F mg/L	✓	0.66	30	50060-Cl_2, Combined Res. mg/L		10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L		11
945-Sulfate as SO_4 mg/L	✓	4	2	550-Oil and Grease mg/L		12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓ 0.04	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L		14
71900-Mercury-Total as Hg ug/L	✓	<0.2	5	610-Ammonia Nitrogen as N mg/L		15
1051-Lead as Pb ug/L	✓	60	6	605-Organic Nitrogen as N mg/L		16
1042-Copper as Cu ug/L	✓	103	7	58-Flow Rate CFM		17
1002-Arsenic as As ug/L	✓	2	8	61-Flow Rate CFS, Instantaneous		18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily		19
1092-Zinc as Zn ug/L	✓	36	10	Beryllium	✓ <1	
955-Silica as SiO_2 mg/L			11			

Remarks: ______

PH-0540
WQC-6/79

REPORT OF ANALYSES

Division of Water Quality Control — Tennessee Department of Public Health

SOURCE: AEDC Landfill Tullahoma Mi: (WELL #5)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells around landfill

Field Number ______ Collected By SAD NHT Primary Station Number ______ Date Collected 801014

Time Collected ______ Sample Depth (ft) ______ Laboratory No. 5WM 1182

10-Temperature °C			2	340-C.O.D. mg/L (High Level)			12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	10	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L			14
403-pH, Lab.	✓	7.2	5	412 Alkalinity (Net) mg/L			15
400-pH, Field			6	38260-MBAS mg/L	✓	0.03	16
81-App. Color Pt - Co units	✓	92	7	95-Conductivity Micromho 25 °C	✓	545	17
80-True Color Pt - Co units	✓	14	8	1105-Aluminum as Al ug/L			18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓	70	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L			20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L			21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓	<1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L			23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓	1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L			25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓	<1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓	<10	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L			28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L		0.01	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓	0.05	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L			1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L			2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L			3
635-Total Kjl. Nitrogen as N mg/L	✓	<0.1	24	545-Settleable Residue ml/L			4
630-NO_3 & NO_2 as N mg/L		0.06	25	666-Diss. Phosphate as P mg/L			5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L			6
1045-Iron as Fe ug/L	✓	2100	27	746-Sulfide, Dissolved as S mg/L			7
1055-Manganese as Mn ug/L	✓	56	28	369-Cl_2 Demand, 30 min. mg/L			8
940-Chloride as Cl mg/L	✓	10	29	50064-Cl_2, Free Res. mg/L			9
950-Fluoride as F mg/L	✓	0.77	30	50060-Cl_2, Combined Res. mg/L			10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L			11
945-Sulfate as SO_4 mg/L	✓	4	2	550-Oil and Grease mg/L			12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓	<0.02	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L			14
71900-Mercury-Total as Hg ug/L	✓	<0.2	5	610-Ammonia Nitrogen as N mg/L			15
1051-Lead as Pb ug/L	✓	80	6	605-Organic Nitrogen as N mg/L			16
1042-Copper as Cu ug/L	✓	110	7	58-Flow Rate GPM			17
1002-Arsenic as As ug/L	✓	<1	8	61-Flow Rate CFS, Instantaneous			18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily			19
1092-Zinc as Zn ug/L	✓	50	10	Beryllium	✓	<1	
955-Silica as SiO_2 mg/L			11				

Remarks: ______

PH-0541
WQ-6/75

REPORT OF ANALYSES

Division of Water Quality Control — Tennessee Department of Public Health

SOURCE: AEDC Landfill Tullahoma Mile: (WELL #6)

IDENTIFICATION: Annual Sampling of 6 Monitoring Wells around Landfill

Field Number ______ Collected By 3RD NHT Primary Station Number ______ Date Collected 800124

Time Collected ______ Sample Depth (ft) ______ Laboratory No SWM 1187

10-Temperature °C			2	340-C.O.D. mg/L (High Level)			12
300-D.O. mg/L			3	335 C.O.D. mg/L (Low Level)	✓	6	13
310-5-day B.O.D. 20 °C mg/L			4	70508 Acidity Total - Hot mg/L			14
403-pH, Lab.	✓	7.1	5	412 Alkalinity (Net) mg/L			15
400-pH, Field			6	38260-MBAS mg/L	✓	0.05	16
81-App. Color Pt - Co units	✓	152	7	95-Conductivity Micromho 25 °C	✓	378	17
80-True Color Pt - Co units	✓	19	8	1105-Aluminum as Al ug/L			18
70-Turbidity NTU			9	1007-Barium as Ba ug/L	✓	50	19
410-Total Alk. as $CaCO_3$ mg/L			10	1032-Chromium-Hex. as Cr. ug/L			20
415-Phth. Alk. As $CaCO_3$ mg/L			11	1033-Chromium-Tri. as Cr. ug/L			21
437-Acidity as $CaCO_3$ mg/L			12	1034-Chromium-total as Cr. ug/L	✓	<1	22
900-Total Hardness as $CaCO_3$ mg/L			13	1037-Cobalt as Co ug/L			23
910-Calcium as $CaCO_3$ mg/L			14	1147-Selenium-total as Se ug/L	✓	<1	24
927-Magnesium as Mg mg/L			15	1145-Selenium (Diss.) as Se ug/L			25
929-Sodium as Na mg/L			16	1077-Silver as Ag ug/L	✓	<1	26
937-Potassium as K mg/L			17	32730-Phenols ug/L	✓	<10	27
500-Total Residue mg/L			18	1022-Boron-Total as B ug/L			28
530-Sus. Residue mg/L			19	615-Nitrite Nitrogen as N mg/L		0.02	29
515-Diss. Residue mg/L			20	620-Nitrate Nitrogen as N mg/L	✓	0.06	30
31501-Coliform No./100 ml			21	405-Free CO_2 mg/L			1
31616-Fecal Coliform No./100 ml.			22	505-Total Vol. Residue mg/L			2
31679-Fecal Strep. No./100ml.			23	535-Vol. Sus. Residue mg/L			3
635-Total Kjl. Nitrogen as N mg/L	✓	<0.1	24	545-Settleable Residue ml/L			4
630-NO_3 & NO_2 as N mg/L		0.08	25	666-Diss. Phosphate as P mg/L			5
1097-Antimony as Sb ug/L			26	745-Sulfide, total as S mg/L			6
1045-Iron as Fe ug/L	✓	1400	27	746 Sulfide, Dissolved as S mg/L			7
1055-Manganese as Mn ug/L	✓	56	28	369-Cl_2 Demand, 30 min. mg/L			8
940-Chloride as Cl mg/L	✓	11	29	50064-Cl_2, Free Res. mg/L			9
950-Fluoride as F mg/L	✓	0.16	30	50060-Cl_2, Combined Res. mg/L			10
665-Total Phosphate as P mg/L			1	690-Total Carbon mg/L			11
945-Sulfate as SO_4 mg/L	✓	43	2	550-Oil and Grease mg/L			12
680-Total Organic Carbon mg/L			3	720-Cyanide as CN mg/L	✓	<0.02	13
1067-Nickel as Ni ug/L			4	32240-Tannin and Lignin mg/L			14
71900-Mercury-Total as Hg ug/L	✓	<0.2	5	610-Ammonia Nitrogen as N mg/L			15
1051-Lead as Pb ug/L	✓	<10	6	605-Organic Nitrogen as N mg/L			16
1042-Copper as Cu ug/L	✓	31	7	58-Flow Rate CFM			17
1002-Arsenic as As ug/L	✓	2	8	61-Flow Rate CFS, Instantaneous			18
1027-Cadmium as Cd ug/L	✓	<1	9	60-Flow Rate CFS, Mean Daily			19
1092-Zinc as Zn ug/L	✓	41	10	Beryllium	✓	<1	
955-Silica as SiO_2 mg/L			11				

Remarks: ______

PH-054 W-22-5

AEDC SANITARY LANDFILL WELL ANALYSES

DATE: 3/18/81

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.04
COD, mg/l Q&A	26	187	8	22	10	10
Conductance, umho/cm-Q&A	455	1,205	343	676	521	388
Copper, ppm-A						
Cyanide, mg/l -Q&A	< .02	< .02	< .02	< .02	< .02	< .02
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Manganese (Mn), ppm-A						
Mercury (Hg), ppb-Q&A	< 0.2	0.6	< 0.2	0.4	0.2	0.2
Nitrate-N, mg/l -A						
pH-Q&A	7.1	6.6	7.4	7.0	7.3	7.3
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level, ft.	17'3"	14'2"	3'2"	5'8"	7'11"	16'6"

AEDC SANITARY LANDFILL WELL ANALYSES

DATE: 4/81
1044-228

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
COD, mg/l Q&A	20	292	<5	10	6	112
Conductance, umho/cm-Q&A	500	1379	385	714	571	513
Copper, ppm-A						
Cyanide, mg/l -Q&A	<.02	<.02	<.02	<.02	<.02	<.02
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn), ppm-A						
Mercury (Hg), ppb-Q&A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate-N, mg/l -A						
pH-Q&A	7.0	6.5	7.4	7.0	7.2	7.0
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level, ft.	17'0"	13'8"	4'1"	6'10"	8'1"	13'3"

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 16 July 1981
Reservoir Level* 1067.0 ft.

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	0.34
COD, mg/l Q&A	<5	237	<5	20	<5	5
Conductance, umho/cm-Q&A	513	1,333	388	826	588	455
Copper, ppm-A						
Cyanide, mg/l -Q&A	<.02	<.02	<.02	<.02	<.02	<.02
Flouride, mg/l -A						
Iron, (Fe), ppm-A	0.24	0.55	1.4	0.39	0.14	0.52
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn), ppm-A	0.01	0.14	0.02	0.02	0.02	0.19
Mercury (Hg), ppb-Q&A	0.7	2.2	0.3	0.8	0.6	0.3
Nitrate-N, mg/l -A						
pH-Q&A	7.1	6.5	7.4	7.0	7.1	7.3
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level,* ft.	18'10"	14'2"	4'8"	8'1"	9'2"	15'10"

* Prior to pumping the wells

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 17 November 1981

Reservoir Level* 1067.3

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A	0.002	0.004	0.002	0.003	0.002	0.003
Barium (Ba), ppm-A	<0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1
Beryllium (Be), ppm-A	< 0.02	< 0.02	<0.02	< 0.02	<0.02	<0.02
Cadmium (Cd), ppm-A	< 0.01	< 0.01	<0.01	< 0.01	<0.01	<0.01
Chloride, ppm-A	2.8	16.5	4.1	42.1	9.8	12.1
Chromium (Cr), ppm-Q&A	< 0.01	0.02	<0.01	< 0.01	0.02	< 0.01
COD, mg/1 Q&A	21	335	6	25	6	9
Conductance, umho/cm-Q&A **	500	1,149	324	680	454	346
Copper, ppm-A	0.10	0.09	0.08	0.08	0.16	0.06
Cyanide, mg/1 -Q&A	<0.02	< 0.02	<0.02	< 0.02	<0.02	<0.02
Flouride, mg/1 -A	0.39	1.0	0.43	0.6	0.78	0.18
Iron, (Fe), ppm-A	0.47	0.32	0.26	0.97	0.42	1.6
Kjeldahl-N, mg/1 -A	0.7	0.15	0.77	0.91	0.65	1.6
Lead (Pb), ppm-Q&A	<0.05	< 0.05	<0.05	<0.05	< 0.05	<0.05
Manganese (Mn), ppm-A	0.01	0.22	0.01	0.07	0.02	0.18
Mercury (Hg), ppb-Q&A	<0.2	0.8	0.4	0.5	0.6	0.6
Nitrate-N, mg/1 -A	0.53	82.0	0.3	0.66	0.37	0.51
pH-Q&A **	6.76	6.11	6.92	6.70	7.01	7.08
Selenium (Se), ppb-A	<0.001	< 0.001	<0.001	< 0.001	< 0.001	<0.001
Silver (Ag) ppm-Q&A	<0.01	< 0.01	<0.01	< 0.01	< 0.01	<0.01
Sulfate (SO_4), ppm-A	5.4	4.1	1.4	2.5	4.4	2.9
Zinc (Zn), ppm-A	0.06	0.06	0.05	0.04	0.05	0.06
Well Water Level,* ft.	15'3"	15'3"	4'1"	6'7"	10'9"	16'4"

* Prior to pumping the wells

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 17 November 1981

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Odor, T.O.N. Units -A	3	11	1	15	1	1
Color, - A Pt.-Co. Units	<4	< 4	< 4	<4	< 4	<4
MBA Substances, mg/l-A	<0.03	< 0.03	<0.03	0.04	<0.03	<0.03
Endrin, mg/l - A	<0.0001	< 0.0001	<0.0001	< 0.0001	<0.0001	< 0.0001
Lindane, mg/l - A	<0.0001	< 0.0001	<0.0001	< 0.0001	<0.0001	< 0.0001
Methoxychlor, mg/l - A	<0.0001	< 0.0001	<0.0001	< 0.0001	<0.0001	< 0.0001
Toxaphene, mg/l - A	<0.0001	< 0.0001	<0.0001	< 0.0001	<0.0001	< 0.0001
2, 4-D, mg/l - A	<0.0004	< 0.0004	<0.0004	< 0.0004	<0.0004	< 0.0004
2,4,5-TP Silvex, mg/l - A	<0.0003	< 0.0003	<0.0003	< 0.0003	<0.0003	< 0.0003
PCB, mg/l - A	<0.0001	< 0.0001	<0.0001	< 0.0001	<0.0001	< 0.0001
Phenols, mg/l - A	<0.01	< 0.01	<0.01	0.07	<0.01	< 0.01
Acetone, mg/l - A	<1.0	10.3	<1.0	<1.0	<1.0	<1.0
Methylchloroform, mg/l-A	SEE 1,1,1 - TRICHLOROETHANE BELOW					
MEK, mg/l - A	<.03	45.13	< 0.03	< 0.03	< 0.03	< 0.03
Toluene, mg/l - A	< 0.01	18.6	<0.01	0.69	0.01	<0.01
Varsol, mg/l - A	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Xylene, mg/l - A	< 0.01	0.17	<0.01	0.40	< 0.01	< 0.01
Total Organic Carbon mg/l Q&A **	4.7	112.5	53	89	29	44.5
1,1,1 - trichloroethane mg/l Q&A**	.01	17	.03	12	.14	.04
1,1,2,2 - tetrachloroethylene mg/l Q&A**	.01	96	.02	.57	19	.01
trichloroethylene mg/l Q&A**	.01	121	.02	.10	.08	.01

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 9 Feb 82

Reservoir Level* 1066.9

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	<0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05
COD, mg/l Q&A	7	216	5	13	< 5	6
Conductance, μmho/cm-Q&A **	353	1080	330	600	465	385
Copper, ppm-A						
Cyanide, mg/l -Q&A	<0.1	< 0.1	<0.1	< 0.1	< 0.1	<0.1
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Manganese (Mn), ppm-A						
Mercury (Hg), ppb-Q&A	<0.2	2.3	< 0.2	< 0.2	< 0.2	<0.2
Nitrate-N, mg/l -A						
pH-Q&A **	6.8	6.4	7.3	6.6	6.8	6.8
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	<0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level,* ft.	9'3"	9'13"	2'7"	4'11"	7'7"	9'2"

* Prior to pumping the wells
** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 9 Feb 82

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Odor, Bt-Co Units -A						
Color, - A						
MBA Substances, mg/l-A						
Endrin, mg/l - A						
Lindane, mg/l - A						
Methoxychlor, mg/l - A						
Toxaphene, mg/l - A						
2, 4-D, mg/l - A						
2,4,5-TP Silvex, mg/l - A						
PCB, mg/l - A						
Phenols, mg/l - A						
Acetone, mg/l - A						
Methylchloroform, mg/l-A						
MEK, mg/l - A						
Toluene, mg/l - A						
Varsol, mg/l - A						
Xylene, mg/l - A						
Total Organic Carbon mg/l Q&A **	<1	22	< 1	<1	< 1	< 1
1,1,1 - trichloroethane mg/l Q&A**	<0.01	13.66	0.02	7.44	0.09	0.11
1,1,2,2 - tetrachloroethylene mg/l Q&A**	0.01	50.54	0.02	0.46	9.95	0.01
trichloroethylene mg/l Q&A**	<0.01	118	0.01	0.01	0.03	<0.01

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 15 April 1982

Reservoir Level* 1068.1

Q = analyze quarterly

A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	10'1"	10'10"	2'8"	5'3"	6'7"	9'0"
pH - Q&A **	7.45	6.58	7.10	6.85	7.00	7.18
Conductance, $_{u}$mho/cm - Q&A**	389	1218	407	726	541	437
Cyanide, mg/l - Q&A	0.01	0.188	0.016	0.011	0.01	0.01
Nitrate-N, mg/l - Q&A	——	45	——	——	——	——
Chromium (Cr), ppm - Q&A	<0.01	< 0.01	< 0.01	<0.01	< 0.01	< 0.01
Lead (Pb), ppm - Q&A	<0.05	< 0.05	<0.05	<0.05	< 0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.2	0.74	<0.2	<0.2	< 0.2	<0.2
Silver (Ag) ppm - Q&A	<0.01	< 0.01	<0.01	<0.01	< 0.01	<0.01
Total Organic Carbon mg/l - Q&A**	10	67	8	13	5	6
1,1,1 - trichloroethane mg/l - Q&A**	0.01	13	0.03	12	0.08	0.04
1,1,2,2 - tetrachloroethylene mg/l - Q&A**	0.02	40.3	0.10	0.63	3.76	0.03
trichloroethylene mg/l - Q&A**	0.04	84.3	0.03	0.10	0.04	0.01

* Prior to pumping the wells

** Average of 4 replicates

2074-124C
AWD 101615-02

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 21 July 1982
Reservoir Level* 1066.7

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	18'7"	15'4"	4'9"	7'9"	8'8"	17'7"
pH - Q&A **	7.0	6.6	7.3	7.0	7.2	7.5
Conductance, μmho/cm - Q&A**	456	1,392	365	751	520	408
Cyanide, mg/l - Q&A	none	0.77	none	none	none	none
Nitrate-N, mg/l - Q&A		60.				
Chromium (Cr), ppm - Q&A	<0.01	0.03	<0.01	0.03	0.08	0.12
Lead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.2	1.8	0.21	0.73	0.62	0.21
Silver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon mg/l - Q&A**	21	403	27	39	35	18
1,1,1 - trichloroethane mg/l - Q&A**	<.01	17.72	0.08	9.13	0.17	0.04
1,1,2,2 - tetrachloroethylene mg/l - Q&A**	<.01	24.13	0.41	0.65	9.23	0.10
trichloroethylene mg/l - Q&A**	<.01	25.06	0.11	0.21	0.09	<.01

Note: Samples for radionuclide analysis sent to Brooks AFB

* Prior to pumping the wells

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 3 November 1982

Q = analyze quarterly

A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm - A	0.001	0.002	0.003	<0.001	0.006	0.002
Barium (Ba), ppm - A	<0.01	<0.1	<0.01	<0.01	<0.1	<0.1
Beryllium (Be), ppm - A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium (Cd), ppm - A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloride, ppm - A	<1	25	6	37	8	12
Copper, ppm - A	0.06	0.07	0.09	0.15	0.12	0.09
Flouride, mg/l - A	<0.06	0.62	0.06	0.38	<0.06	<0.06
Iron, (Fe), ppm - A	0.50	0.25	1.3	6.3	3.4	4.6
Manganese (Mn), ppm - A	<0.01	0.20	0.20	0.06	0.09	0.27
Selenium (Se), ppb - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate (SO_4), ppm - A	<1	1	<1	<1	1	1
Zinc (Zn), ppm - A	0.05	0.10	0.07	0.11	0.12	0.12
Endrin, mg/l - A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lindane, mg/l - A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Methoxychlor, mg/l - A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Toxaphene, mg/l - A	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
2, 4-D, mg/l - A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
2,4,5-TP Silvex, mg/l - A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenols, mg/l - A	<0.01	0.012	<0.01	0.032	<0.01	<0.01
Toluene, mg/l - A	<0.01	3.43	<0.01	0.03	0.01	<0.01
Methylene chloride mg/l - A	0.09	47.50	0.92	1.03	0.09	<0.01

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 3 November 1982

Reservoir Level* 1066.7

Q = analyze quarterly

A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	18'7"	15'4"	4'9"	7'9"	8'8"	17'7"
pH - Q&A **	7.1	6.6	7.3	7.1	7.3	7.3
Conductance, μmho/cm - Q&A**	418	1250	292	659	517	338
Cyanide, mg/l - Q&A	<.02	0.31	<0.02	<0.02	<0.02	<0.02
Nitrate-N, mg/l - Q&A	0.74	78.0	0.63	0.92	0.77	1.12
Chromium (Cr), ppm - Q&A	<0.01	<0.1	<0.1	0.06	0.07	<0.01
Lead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.2	1.8	0.6	0.8	0.3	<0.2
Silver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Total Organic Carbon mg/l - Q&A**	6	170	4	40	43	4
1,1,1 - trichloroethane mg/l - Q&A**	<0.01	14	0.03	6	.08	.03
1,1,2,2 - tetrachloroethylene mg/l - Q&A**	0.01	51.0	0.13	0.24	6.93	0.01
trichloroethylene mg/l - Q&A**	0.02	105.2	0.02	0.44	0.05	<.01

* Prior to pumping the wells

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 2 February 1983

Reservoir Level* 1068.35

Q = analyze quarterly

A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	11'6"	11'8"	4'5"	6'9"	7'11"	10'8"
pH - Q&A **	7.3	6.6	7.3	6.9	7.0	7.1
Conductance, μmho/cm - Q&A**	364	1008	360	690	530	430
Cyanide, mg/l - Q&A	<0.02	0.52	<0.02	<0.02	<0.02	<0.02
Nitrate-N, mg/l - Q&A		51				
Chromium (Cr), ppm - Q&A	<0.01	<0.01	<0.01	0.03	0.01	0.01
Lead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.2	0.5	<0.2	0.7	<0.2	<0.2
Silver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon mg/l - Q&A**	4	100	2	13	1	3
1,1,1 - trichloroethane μg/l - Q&A**	16	9855	36	7137	88	48
1,1,2,2 - tetrachloroethylene μg/l - Q&A**	16	50735	130	360	7140	34
trichloroethylene μg/l - Q&A**	8	83327	16	30	53	12

* Prior to pumping the wells

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 2 February 1983

Reservoir Level* 1068.35

Q = analyze quarterly

A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	1071.2 11'6"	1068.2 11'8"	1066.9 4'5"	1062.2 6'9"	1062.1 7'11"	1062.[illegible] 10'8"
pH - Q&A **	7.3	6.6	7.3	6.9	7.0	7.1
Conductance, μmho/cm - Q&A**	364	1008	360	690	530	430
Cyanide, mg/l - Q&A	<0.02	0.52	<0.02	<0.02	<0.02	<0.02
Nitrate-N, mg/l - Q&A		51				
Chromium (Cr), ppm - Q&A	<0.01	<0.01	<0.01	0.03	0.01	0.01
Lead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.2	0.5	<0.2	0.7	<0.2	<0.2
Silver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon mg/l - Q&A**	4	100	2	13	1	3
1,1,1 - trichloroethane μg/l - Q&A**	16	9855	36	7137	88	48
1,1,2,2 - tetrachloroethylene μg/l - Q&A**	16	50735	130	360	7140	34
trichloroethylene μg/l - Q&A**	8	83327	16	30	53	12
	1082.7 − 11.5	1079.4 − 11.7	1071.3 − 4.4	1074.0 − 6.8	1075.6 − 7.9	[illegible] − 10.8

Note: Corrections (red) made with adjustment to Grnd. Elev. [illegible], i.e., 11'6" [illegible] for casing height, ∴ Grnd Elev (A) − Casing height (B) = Grnd H_2O Elev. [illegible]

* Prior to pumping the wells

** Average of 4 replicates

AWJ No. 104726-01

No. 271924

Date Sampled 2-23-83

AEDC SANITARY LANDFILL WELL ANALYSES

	pH	Specific Conductance umho/cm	Methyl-Chloroform ppb	Perchloro-ethylene ppb	Trichloro-ethylene ppb	TOC
Well No. 1						
Sample No. 1	7.3	357	<16	<16	8	5
2	7.3	364	<16	<16	8	6
3	7.3	364	<16	<16	8	3
4	7.3	370	<16	<16	8	3
Well No. 2						
Sample No. 1	6.6	971	8,700	43,010	71,680	39
2	6.5	1020	10,240	55,100	84,600	139
3	6.6	1020	10,620	55,100	89,600	153
4	6.6	1020	9,860	49,730	82,430	68
Well No. 3						
Sample No. 1	7.3	357	38	210	31	<1
2	7.3	360	38	97	11	6
3	7.3	360	38	113	11	2
4	7.3	364	32	101	11	1
Well No. 4						
Sample No. 1	6.9	690	6,660	319	34	9
2	6.9	685	6,820	363	39	7
3	6.9	690	6,910	422	13	9
4	6.9	695	8,160	338	34	27
Well No. 5						
Sample No. 1	7.0	526	99	7,390	78	<1
2	7.0	526	71	7,530	45	<1
3	7.0	532	94	7,260	45	<1
4	7.0	535	87	6,380	45	<1
Well No. 6					4-5-83	
Sample No. 1	7.1	431	50	<16	8	2
2	7.1	442	50	<16	8	6
3	7.1	426	50	88	24	4
4	7.1	420	40	<16	8	<1

AEDC SANITARY LANDFILL WELL ANALYSES

DATE: February 23, 1983
3024-141C

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
enic (As), ppm-A						
ium (Ba), ppm-A						
yllium (Be), ppm-A						
mium (Cd), ppm-A						
oride, ppm-A						
omium (Cr), ppm-Q&A	<0.01	<0.01	<0.01	0.03	0.01	0.01
~~[illegible]~~&A						
nductance, μmho/cm - Q&A						
oper, ppm-A						
anide, mg/ℓ-Q&A	<0.02	0.52	<0.02	<0.02	<0.02	<0.0
ouride, mg/ℓ -A						
on, (Fe), ppm-A						
eldahl-N, mg/ℓ-A						
ead (Pb), ppm-Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
nganese (Mn), ppm-A	<0.2	0.5	<0.2	0.7	<0.2	<0.2
ercury (Hg), ppb-Q&A						
itrate-N, mg/ℓ -A		51				
H-Q&A						
elenium (Se), ppb-A						
ilver (Ag) ppm -Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.0
ulfate (SO_4), ppm -A						
Zinc (Zn), ppm -A						
Well Water Level, ft.	11'6"	11'8"	4'5"	6'9"	7'11"	10'5
etention Pond level	1068.35 ft		4-5-83			

AEDC SANITARY LANDFILL WELL ANALYSES

QUARTERLY

Lab. No.: 2043-106C

DATE SAMPLED: 4/15/83

RESERVOIR LEVEL: 1068.1

Well #

Parameter	1		2		3		4		5		6	
Ag, ppm	<.01		<.01		<.01		<.01		<.01		<.01	
Cr, ppm	<.01		<.01		<.01		<.01		<.01		<.01	
Hg, ppb	<0.2		0.74		<0.2		<0.2		<0.2		<0.2	
Pb, ppm	<.05		<.05		<.05		<.05		<.05		<.05	
CN, ppm	0.01		0.188 45		0.016		0.011		0.01		0.01	
NO_3-N (2 only)	—		—		—		—		—		—	
pH	7.5	7.4	6.5	6.6	6.9	7.2	6.9	6.8	7.0	7.0	7.2	7.1
pH	7.4	7.5	6.6	6.6	7.1	7.2	6.8	6.9	7.0	7.0	7.2	7.2
Sp. Cond.	388	391	1220	1220	431	385	730	719	556	540	420	429
Sp. Cond.	385	392	1212	1220	426	385	725	730	538	529	427	472
Perchlor ppm/wt	0.02	0.02	31.04	36.48	.09	.13	0.54	.61	9.22	8.77	.10	.01
Perchlor ppm/wt	0.02	0.02	44.16	41.60	.07	.09	.78	.60	8.70	8.35	.01	.01
Trichlor ppm/wt	0.04	0.03	72.50	80.64	.03	.03	.05	.05	.04	.04	.01	<.01
Trichlor ppm/wt	0.04	0.03	93.20	86.02	.03	.03	0.17	0.12	.03	.03	<.01	<.01
Methyl $CHCl_3$ ppm/wt	0.01	0.01	13.13	12.67	.02	.03	10.14	11.98	.09	.08	.03	.04
Methyl $CHCl_3$ ppm/wt	<.01	<.01	14.40	11.81	.02	.03	16.13	10.83	.08	.08	.04	.04
TOC outside	1. 8	3. 6	1. 71	3. 46	1. 5	3. 8	1. 8	3. 8	1. 2	3. 12	1. <1	3. 7
lab, mg/L	2. 8	4. 19	2. 75	4. 75	2. 12	4. 7	2. 26	4. 9	2. 2	4. 2	2. 4	4. 13
Well H_2O lev. *	10'1"		10'10"		2'8"		5'3"		6'7"		9'0"	

* Prior to pumping wells.

TS APPROVED 5-27-83

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 11 May 83
Reservoir Level* 1067.2

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Well Water Level,* ft.	9' 8"	10' 4"	2' 11"	5' 5"	6' 11"	8' 6"
pH - Q&A **	7.1	6.6	7.3	6.9	7.0	7.3
Conductance, μmho/cm - Q&A**	357	929	344	691	543	400
Cyanide, mg/l - Q&A	0	0.136	0	0	0	0
Nitrate-N, mg/l - Q&A	—	56	—	—	—	—
Chromium (Cr), ppm - Q&A	<0.01	<0.01	<0.01	0.03	<0.01	0.02
Lead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg), ppb - Q&A	<0.1	1.5	<0.1	<0.1	<0.1	<0.1
Silver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Organic Carbon mg/l - Q&A**	7	125	7	16	8	8
1,1,1 - trichloroethane μg/l - Q&A**	<1 ~~<0.0012~~	6,726	42	7296	906	30
1,1,2,2 - tetrachloroethylene μg/l - Q&A**	~~<0.020~~ ~~<0.02~~ <20	44,460	158	400	6385	18
trichloroethylene μg/l - Q&A**	~~<0.014~~ <14	69,904	20	<12 ~~<0.012~~	40	<13 ~~<0.013~~

* Prior to pumping the wells

** Average of 4 replicates

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 11 May 83
Reservoir Level* 1067.2

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	<0.01	<0.01	<0.01	0.03	<0.01	0.02
COD, mg/l Q&A						
Conductance, umho/cm-Q&A	see	attached sheet				
Copper, ppm-A						
Cyanide, mg/l -Q&A	0	0.136	0	0	0	0
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn), ppm-A						
Mercury (Hg), ppb-Q&A	<0.1	1.5	<0.1	<0.1	<0.1	<0.1
Nitrate-N, mg/l -A	/	56	/	/	/	/
pH-Q&A	see	attached sheet				
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level,* ft.	8'8"	10'4"	2'11"	5'5"	6'11"	8.6

* Prior to pumping the wells

TS APPROVED MJS 9-12-83

Lab. No. [illegible]
A[illegible] No. 104726-01
W/O No. 271924
Date Sampled 11 May 83

AEDC SANITARY LANDFILL WELL ANALYSES

	pH	Specific Conductance umho/cm	Methyl-Chloroform, ppm	Perchloro-ethylene, ppm	Trichloro-ethylene, ppm	TOC, ppm
Well No. 1						
Sample No. 1	7.1	357	<0.012	<0.020	<0.014	5
2	7.1	358	<0.012	<0.020	<0.014	6
3	7.1	353	<0.012	<0.020	<0.014	9
4	7.1	360	<0.012	<0.020	<0.014	8
Well No. 2						
Sample No. 1	6.6	901	6.200	41.891	66.368	120
2	6.6	917	7.320	45.843	70.720	125
3	6.5	971	6.660	45.843	70.720	125
4	6.7	926	6.720	44.262	71.808	127
Well No. 3						
Sample No. 1	7.3	339	0.048	0.178	0.037	6
2	7.3	344	0.048	0.168	0.018	6
3	7.3	346	0.048	0.138	0.018	7
4	7.3	346	0.024	0.148	<.018	8
Well No. 4						
Sample No. 1	6.9	671	7.661	0.405	<.012	14
2	6.9	699	7.296	0.409	<.012	21
3	6.9	699	7.418	0.414	<.012	12
4	6.9	694	6.810	0.373	<.012	18
Well No. 5						
Sample No. 1	7.0	541	1.034	6.477	0.041	10
2	7.0	546	0.851	6.330	0.041	6
3	7.0	541	0.912	6.330	0.037	6
4	7.0	546	0.876	6.403	0.041	[illegible]
Well No. 6						
Sample No. 1	7.3	395	0.015	0.019	<.013	8
2	7.3	402	0.019	<0.014	<.013	8
3	7.3	403	0.019	0.019	<.013	7
4	7.3	400	0.038	<0.019	<.013	7

TSG APPROVED
0-12-83

#3093-052C

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 9-09-83

Reservoir Level* 1,067.3

Q = analyze quarterly
A = analyze annually

Well no.

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
✓ Chromium (Cr), ppm-Q&A	<0.01	0.05	<0.01	<0.01	0.02	<0.01
COD, mg/l Q&A						
Conductance, umho/cm-Q&A						
Copper, ppm-A						
Cyanide, mg/l -Q&A	<0.02	0.46 / 0.43**	<0.02	<0.02	<0.02	<0.02
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
✓ Lead (Pb), ppm-Q&A	<0.05	0.18	<0.05	<0.05	<0.05	<0.05
Manganese (Mn), ppm-A						
✓ Mercury (Hg), ppb-Q&A	<0.2	0.65	<0.2	<0.2	<0.2	<0.2
Nitrate-N, mg/l -A	—	230.	—	—	—	—
pH-Q&A						
Selenium (Se), ppb-A						
✓ Silver (Ag) ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level* ft. below ground level	16'8"	13'5"	2'8"	5'7"	6'6"	14'9"

*Prior to pumping the wells ** Duplicate Sample

3093-052C

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 9-09-83

Reservoir Level* 1,067.3

Q = analyze quarterly
A = analyze annually

well no.

WELL NO.	7	8				
Arsenic (As), ppm-A						
Barium (Ba), ppm-A						
Beryllium (Be), ppm-A						
Cadmium (Cd), ppm-A						
Chloride, ppm-A						
Chromium (Cr), ppm-Q&A	<0.01	<0.01				
COD, mg/l Q&A						
Conductance, umho/cm-Q&A						
Copper, ppm-A						
Cyanide, mg/l -Q&A	<0.02	<0.02				
Flouride, mg/l -A						
Iron, (Fe), ppm-A						
Kjeldahl-N, mg/l -A						
Lead (Pb), ppm-Q&A	<0.05	<0.05				
Manganese (Mn), ppm-A						
Mercury (Hg), ppb-Q&A	<0.2	<0.2				
Nitrate-N, mg/l -A	0.86	1.1				
pH-Q&A						
Selenium (Se), ppb-A						
Silver (Ag) ppm-Q&A	<0.01	<0.01				
Sulfate (SO_4), ppm-A						
Zinc (Zn), ppm-A						
Well Water Level,* ft. below ground level	3'11"	3'3"				

*Prior to pumping the wells

W/O No. 271924

Date Sampled 9/9/83

AEDC SANITARY LANDFILL WELL ANALYSES

		pH	Specific Conductance umho/cm	Methyl-Chloroform ppb	TRI ~~Te~~chloro-ethylene ppb	PER ~~Tri~~chloro-ethylene ppb	TOC
Well No. 1							
Sample No.	1	7.9	126	<7	<6	<10	4
	2	8.4	125	<7	<6	<10	3
	3	8.1	160	<7	<6	<10	3
	4	8.5	153	<7	<6	<10	4
Well No. 2							
Sample No.	1	6.4	1,166	11,696	84,480	57,792	67
	2	6.6	1,167	11,424	74,880	57,384	62
	3	6.5	1,229	11,968	70,272	56,448	65
	4	6.5	1,203	12,784	84,480	59,539	67
Well No. 3							
Sample No.	1	7.0	307	37.4	7.2	278.4	3
	2	7.3	299	34.0	6.6	201.6	2
	3	7.2	306	34.0	276	730.6	2
	4	7.4	310	40.8	7.2	216.0	2
Well No. 4							
Sample No.	1	6.7	560	9,183	<6	<10	5
	2	6.7	501	2,938	<6	<10	8
	3	6.8	485	9,030	<6	<10	6
	4	6.8	503	9,030	<6	<10	5
Well No. 5							
Sample No.	1	8.9	125	106.0	39.2	539.6	4
	2	8.5	146	3.3	33.6	539.6	<2
	3	8.5	141	3.2	34.7	542.8	5
	4	8.6	152	3.3	34.2	501.6	2
Well No. 6							
Sample No.	1	7.2	378	18.0	<6	<10	2
	2	7.6	363	18.0	<6	<10	5
	3	7.5	371	18.0	<6	<10	4
	4	7.5	376	24.0	<6	<10	3
Well No. 7							
Sample No.	1	6.7	355	144.0	1,837	1,398	<2
	2	6.8	361	156.0	1,837	1,369	<2
	3	6.7	365	156.0	1,964	1,362	2
	4	6.7	363	144.0	1,926	1,353	<2
Well No. 6							
Sample No.	1	7.0	385	1,920	8,122	1,624	4
	2	6.9	382	1,824	8,422	1,560	2
	3	6.9	366	1,752	8,143	1,584	3
	4	6.7	383	1,728	8,549	2,637	3

Date Sampled 7/7/83

AEDC SANITARY LANDFILL WELL ANALYSES

	pH	Specific Conductance umho/cm	Methyl-Chloroform ppb	~~Tetra~~ TRI chloro-ethylene ppb	~~Tri~~ PER chloro-ethylene ppb	TOC
Well No. 1						
Sample No. 1	7.7	126	<7	<6	<10	4
2	8.4	125	<7	<6	<10	3
3	8.1	160	<7	<6	<10	3
4	8.3	153	<7	<6	<10	4
	7.1	140				3.5
Well No. 2						
Sample No. 1	6.4	1,166	11,696	84,480	57,792	67
2	6.6	1,169	11,424	74,880	57,389	62
3	6.5	1,229	11,968	79,872	56,448	65
4	6.5	1,203	12,784	84,480	54,539	67
	6.5	1,192	11,968	80,928	56,792	65.3
Well No. 3						
Sample No. 1	7.0	307	37.4	7.2	278.4	3
2	7.3	299	34.0	6.6	201.6	2
3	7.2	306	34.0	276. ?	730.6 ?	2
4	7.1	310	40.8	7.2	216.0	2
	7.2	306	36.6	7.0	232	2.2
Well No. 4						
Sample No. 1	6.7	500	9 183	<6	<10	5
2	6.7	501	2,939 ?	<6	<10	8
3	6.8	485	9,030	<6	<10	6
4	6.8	503	9,030	<6	<10	5
	6.8	497	9,071			6
Well No. 5						
Sample No. 1	8.9	125	36.0 ?	39.2	534.6	4
2	8.5	116	3.3	33.6	534.6	<2
3	8.5	111	3.2	34.7	542.8	5
4	8.6	152	3.3	34.2	501.6	2
	6.7	142	3.3	35.4	543.3	
Well No. 6						
Sample No. 1	7.5	377	18.0	<6	<10	2
2	7.6	363	18.0	<6	<10	5
3	7.5	371	18.0	<6	<10	4
4	7.5	376	24.0	<6	<10	3
	7.5	375	19.5	-		4
Well No. 7						
Sample No. 1	6.7	377	144.0	1,837	1,348	<2
2	6.8	311	156.0	1,837	1,349	<2
3	6.7	315	156.0	1,904	1,362	2
4	6.7	313	144.0	1,926	1,353	<2
	6.7	361	150.0	1,876	1,270	
Well No. 8						
Sample No. 1	7.0	385	1,920	8,422	1,624	4
2	6.9	382	1,824	8,422	1,560	2
3	6.9	376	1,752	8,243	1,584	3
4	6.7	397	1,728	8,349	2,637 ?	3
	6.7	384	1806	8,109	1703	3

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 20 Oct 83
Reservoir Level* 1067.0

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Arsenic (As), ppm-A	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium (Ba), ppm-A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium (Be), ppm-A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium (Cd), ppm-A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chloride, ppm-A	4	24	5	48	12	10
Chromium (Cr), ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
~~COD, mg/1 Q&A~~						
Conductance, umho/cm-Q&A	see attached sheet					
Copper, ppm-A	0.03	0.05	0.03	0.02	0.01	0.06
Cyanide, mg/1 -Q&A	<0.02	0.21	<0.02	<0.02	<0.02	<0.02
Flouride, mg/1 -A	.39	.94	.50	.42	.72	.25
Iron, (Fe), ppm-A	0.46	0.22	0.13	2.82	0.05	0.36
~~Kjeldahl N, mg/1 -A~~						
Lead (Pb), ppm-Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn), ppm-A	0.01	0.13	0.01	0.05	0.01	0.06
Mercury (Hg), ppb-Q&A	<0.1	0.4	0.4	<0.1	<0.1	<0.1
Nitrate-N, mg/1 -A	1.35	68.0	0.86	1.1	1.8	1.5
pH-Q&A	see attached sheet					
Selenium (Se), ppb-A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag) ppm-Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfate (SO_4), ppm-A	<2	<2	<2	<2	12	<2
Zinc (Zn), ppm-A	0.05	0.06	0.03	0.05	0.02	0.06
Well Water Level,* ft.	19'0"	14'11"	4'5"	7'2"	8'3"	16'9"

* Prior to pumping the wells

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 20 Oct '83

Reservoir Level* 1067.0

Q = analyze quarterly
A = analyze annually

WELL NO.	#7	#8	3	4	5	6
Arsenic (As), ppm-A	<0.001	<0.001				
Barium (Ba), ppm-A	<0.1	<0.1				
Beryllium (Be), ppm-A	<0.01	<0.01				
Cadmium (Cd), ppm-A	<0.01	<0.01				
Chloride, ppm-A	4	19				
Chromium (Cr), ppm-Q&A	<0.01	<0.01				
~~COD, mg/l-Q&A~~						
Conductance, umho/cm-Q&A	See attached sheet					
Copper, ppm-A	0.02	0.02				
Cyanide, mg/l -Q&A	0.0	0.0				
Flouride, mg/l -A	.30	.35				
Iron, (Fe), ppm-A	0.10	0.09				
~~Kjeldahl-N, mg/l -A~~						
Lead (Pb), ppm-Q&A	<0.05	<0.05				
Manganese (Mn), ppm-A	0.02	0.02				
Mercury (Hg), ppb-Q&A	<0.1	<0.1				
Nitrate-N, mg/l -A	1.57	1.8				
pH-Q&A	See attached sheet					
Selenium (Se), ppb-A	<1.0	<1.0				
Silver (Ag) ppm-Q&A	<0.01	<0.01				
Sulfate (SO_4), ppm-A	<2	<2				
Zinc (Zn), ppm-A	0.03	0.02				
Well Water Level,* ft.	6'1"	4'5"				

* Prior to pumping the wells

1-13-84

AEDC SANITARY LANDFILL WELL ANALYSES

DATE SAMPLED: 10-20-83

3103-131c

Q = analyze quarterly
A = analyze annually

WELL NO.	1	2	3	4	5	6
Endrin, ~~mg~~ µg/1 - A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lindane, ~~mg~~ µg/1 - A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor, ~~mg~~ µg/1 - A	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
Toxaphene, ~~mg~~ µg/1 - A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2, 4-D, ~~mg~~ µg/1 - A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-TP Silvex, ~~mg~~ µg/1 - A	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenols, mg/1 - A	<0.01	<0.01	<0.01	0.08	<0.01	<0.01
Methylchloroform, mg/1-A	see attached sheet					
Trichloroethylene	"	"	"			
Toluene, mg/1 - A	"	"	"			
Perchloroethylene	"	"	"			
Methylene Chloride	"	"	"			

AEDC SANITARY LANDFILL WELL ANALYSES

mds 173-81

DATE SAMPLED: 10-20-83

3103-131c

Q = analyze quarterly
A = analyze annually

WELL NO.	7	8	3	4	5	6
Endrin, ~~mg~~ µg/l - A	<0.1	<0.1				
Lindane, ~~mg~~ µg/l - A	<0.05	<0.05				
Methoxychlor, ~~mg~~ µg/l - A	<10.0	<10.0				
Toxaphene, ~~mg~~ µg/l - A	<2.0	<2.0				
2, 4-D, ~~mg~~ µg/l - A	<1.0	<1.0				
2,4,5-TP Silvex, ~~mg~~ µg/l - A	<0.5	<0.5				
Phenols, mg/l - A	<0.01	<0.01				
Methylchloroform, mg/l-A	see attached sheet					
Trichloroethylene	"	"	"			
Toluene, mg/l - A	"	"	"			
Perchloroethylene	"	"	"			
Methylene Chloride	"	"	"			

5103-181C

No. 107408-09

W/O No. 1

Date Sampled 20 Oct '83

mhs
1-13-84

AEDC SANITARY LANDFILL WELL ANALYSES

		pH	Specific Conductance umho/cm	Methyl-Chloroform ppb	Perchloro-ethylene ppb	Trichloro-ethylene ppb	TOC mg/l
Well No. 1							
Sample No.	1	7.9	296				<2
	2	7.9	283				<2
	3	7.8	282				<2
	4	7.8	283				<2
		[illegible]	[illegible]				
Well No. 2							
Sample No.	1	6.6	1220				70
	2	6.7	1188				65
	3	6.6	1189				70
	4	6.6	1180				63
		[illegible]	[illegible]				
Well No. 3							
Sample No.	1	7.5	399				<2
	2	7.4	376				<2
	3	7.5	384				<2
	4	7.3	377				<2
		[illegible]	[illegible]				
Well No. 4							
Sample No.	1	7.2	685				3
	2	7.0	684				3
	3	6.8	618				4
	4	6.7	583				4
		[illegible]	642.5				[illegible]
Well No. 5							
Sample No.	1	8.6	197				<2
	2	8.7	193				<2
	3	8.8	194				<2
	4	8.7	194				2
		[illegible]	[illegible]				
Well No. 6							
Sample No.	1	7.4	411				2
	2	7.4	400				6
	3	7.4	418				4
	4	7.4	414				7

LABORATORY TEST SERVICES
CHEMICAL LAB REPORT
ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE STATION, TENNESSEE 37389

[illegible] AEDC LANDFILL MONITORING WELLS — FILE NO.:

[illegible] ORDER NO.: 1 A.F. NO.: — AWD NO.: 107408-09

[illegible] BY: R.R. KIMBROUGH M/S 100 — REPORT NO.: 3103-1310

[illegible] SUBMITTED: WATER FROM 8 WELLS — DATE COMP.: 28-OCT-8[illegible]

SAMPLED IN QUADRUPLICATE

[illegible] FOR: COMPOUNDS TABULATED BELOW — WORK AUTH. NO.: [illegible]

[illegible] IN: 20-OCT-83 — DATE OUT.

[illegible] NUMBER — NO. OF SAMPLES: [illegible]

[illegible] NO.	METHYLENE CHLORIDE PPB/WT.	METHYL CHLOROFORM PPB/WT.	TRICHLORO-ETHYLENE PPB/WT.	PERCHLORO-ETHYLENE PPB/WT.	[illegible]
1-1	<10	9	7	10	[illegible]
1-2	[illegible]	9	[illegible]	12	[illegible]
1-3	[illegible]	[illegible]	[illegible]	11	[illegible]
1-4	<10	1[illegible]	7	4[illegible]	[illegible]
2-1	332	12,012	66,880	59,200	3,8[illegible]
2-2	[illegible]40	13,356	77,824	66,840	[illegible]
2-3	4[illegible]0	13,692	77,216	72,363	3,0[illegible]
2-4	440	13,860	81,[illegible]72	73,[illegible]40	3,1[illegible]
3-1	<10	37	13	175	[illegible]
3-2	<10	37	14	166	[illegible]
3-3	<10	37	14	166	[illegible]
3-4	<10	36	14	161	[illegible]
4-1	1,490	13,477	46	391	[illegible]
4-2	1,320	13,594	32	340	[illegible]
4-3	1,550	14,515	36	345	[illegible]
4-4	1,[illegible]74	14,515	29	[illegible]	[illegible]
5-1	[illegible]	270	39	759	[illegible]
5-2	16	256	42	674	[illegible]
5-3	11	206	42	785	1[illegible]
5-4	7	227	38	738	[illegible]
6-1	[illegible]	[illegible]	10	10	[illegible]
6-2	[illegible]	17	10	10	[illegible]
6-3	[illegible]	13	10	10	[illegible]
6-4	[illegible]	[illegible]	21	10	[illegible]
7-1	[illegible]	[illegible]	2,37[illegible]	1,320	[illegible]
7-2	[illegible]	[illegible]	2,[illegible]93	1,580	[illegible]
7-3	1[illegible]	[illegible]	2,[illegible]70	1,588	[illegible]
7-4	17	[illegible]	2,[illegible]7	1,622	[illegible]
8-1	10	[illegible]	7,[illegible]16	1,470	[illegible]
8-2	10	[illegible]	7,[illegible]70	[illegible]	[illegible]
8-3	[illegible]	[illegible]	7,357	[illegible]	[illegible]
8-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

LABORATORY TEST SERVICES
CHEMICAL LAB REPORT
ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE STATION, TENNESSEE 37389

A.E.D.C. LANDFILL MONITORING WELLS--QUARTERLY ANALYSIS

WORK ORDER NO.: 1 A.F. NO.: AWD NO.: 107408-08

REQUESTED BY: M. KIMBROUGH M/S 490 REPORT NO.: 4021-015C

MATERIAL SUBMITTED: WELL WATER SAMPLES (32) DATE COMP.: 8 FEB 84

ANALYZE FOR: MC, TCE, PCE. WORK AUTH. NO.: R54D

DATE IN: 1 FEB 84 DATE OUT:

BY: C. BAKER NO. OF SAMPLES: 32

WELL NO.	METHYL CHLOROFORM PPB/WT.	TRICHLORO-ETHYLENE PPB/WT.	PERCHLORO-ETHYLENE PPB/WT.
1-1	<5	<5	<7
1-2	<5	<5	<7
1-3	<5	<5	<7
1-4	<5	<5	<7
2-1	8,528	63,974	59,674
2-2	8,944	71,232	64,051
2-3	8,819	72,576	69,120
2-4	9,256	76,608	61,747
3-1	66	9	146
3-2	63	8	146
3-3	68	38	255
3-4	66	8	135
4-1	6,245	9	260
4-2	6,522	9	266
4-3	6,618	9	261
4-4	7,068	9	260
5-1	33	40	2,346
5-2	35	40	2,419
5-3	40	35	2,333
5-4	35	34	2,074
6-1	28	<4	14
6-2	26	<4	12
6-3	29	<4	11
6-4	27	<4	5
7-1	185	2,861	3,238
7-2	182	2,995	3,216
7-3	143	2,811	3,128
7-4	139	2,573	2,834
8-1	1,030	6,950	1,803
8-2	1,248	7,089	1,858
8-3	1,279	7,450	1,858
8-4	1,238	7,066	1,840

LABORATORY TEST SERVICES
CHEMICAL LAB REPORT
ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE STATION, TENNESSEE 37389

A.E.D.C. LANDFILL MONITORING WELLS--QUARTERLY ANALYSIS

WORK ORDER NO.: 1 A.F. NO.: AWD NO.: 107408-08

REQUESTED BY: M. KIMBROUGH M/S 490 REPORT NO.: 4021-015C

MATERIAL SUBMITTED: WELL WATER SAMPLES (32) DATE COMP.: 8 FEB 84

ANALYZE FOR: MC, TCE, PCE. WORK AUTH. NO.: R54D

DATE IN: 1 FEB 84 DATE OUT:

BY: C. BAKER NO. OF SAMPLES: 32

WELL NO.	METHYL CHLOROFORM PPB/WT.	TRICHLORO- ETHYLENE PPB/WT.	PERCHLORO- ETHYLENE PPB/WT.
1-1	<5	<5	<7
1-2	<5	<5	<7
1-3	<5	<5	<7
1-4	<5 <5	<5 <5	<7 <7
2-1	8,528	63,974	59,674
2-2	8,944	71,232	64,051
2-3	8,819	72,576	69,120
2-4	9,256	76,608	61,747
	8886.8	71097.5	63648
3-1	66	9	146
3-2	63	8	146
3-3	68	38	255
3-4	66	8	135
	65.8	15.8	170.5
4-1	6,245	9	260
4-2	6,522	9	266
4-3	6,618	9	261
4-4	7,068	9	260
	6613	9	261.9
5-1	33	40	2,346
5-2	35	40	2,419
5-3	40	35	2,333
5-4	35	34	2,074
	35.8	37.3	2293
6-1	28	<4	14
6-2	26	<4	12
6-3	29	<4	11
6-4	27	<4 <4	5
	27.5		10.5
7-1	185	2,861	3,238
7-2	182	2,995	3,216
7-3	143	2,811	3,128
7-4	139	2,573	2,834
	162.3	2810	3104
8-1	1,030	6,950	1,803
8-2	1,248	7,089	1,858
8-3	1,279	7,450	1,858
8-4	1,238	7,066	1,840
	1198.8	7138.8	1839.8

LABORATORY TEST SERVICES
Laboratory Section Report

Work Order No. 1

AWD No. 107408-08

Requested by M. Kimbrough - 490

Report No. 4021-015 C

Material Submitted 8 - Landfill Well Samples

Date Completed 2/24/84

Work Auth. R540

Date In 2-1-84

Date Out 3-2-84

By

Instructions:

Quarterly AEDC Landfill Well Analyses

Well No.	1	2	3	4	5	6	7	8
Results: Cr, ppm	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
Pb, ppm	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ag, ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hg, ppb	<0.2	0.25	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
* NO_3^--N, mg/l		73.						
CN^-, mg/l	0	0.150	0	0	0	0	0	0
** Well H_2O Level	11'0"	10'6"	2'10"	5'2"	6'6"	10'1"	3'1"	2'9"
Retention Pond Level -	1068.3							

Remarks:
* Well No, 2 only
** Measured prior to pumping

73 MKS 3-2-84

CC-338 (10/82)

C.K.

AEDC SANITARY LANDFILL WELL ANALYSES WORK COPY

DATE SAMPLED: 12 April 1984

Reservior Elevation* 1068.4

Q = Analyze quarterly
A = Analyze annually

ell No.	1	2	3	4	5	6	7	8
ell Water Elevation - Ft.*	1076.3	1071.8	1070.6	1070.7	1070.1	1072.2	1071.5	1069.1
- Q&A **	6.8	6.6	7.3	7.0	7.9	7.4	7.2	7.3
nductance, μmho/cm-Q&A**	158	1036	432	605	246	372	418	428
anide, mg/l - Q&A	<0.02	0.31	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
trate-N, mg/l - Q&A	—	44.0	—	—	—	—	—	—
romium (Cr), ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ead (Pb), ppm - Q&A	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ercury (Hg), ppb - Q&A	<0.02	.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
lver (Ag) ppm - Q&A	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
otal Organic Carbon g/l - Q&A**	4	60	<2	3	3	3	2	2
.1,1 - trichloro-thane μg/l - Q&A**	<5	11,088	94	10,842	23	15	200	914
.1,2,2 - tetrachloro-thylene μg/l - Q&A**	12	112,761	? 354	1,505	1,308	9	2,730	1,316
ichloroethylene g/l - Q&A**	<5	88,000	9	14	41	6	3,068	5,729

Prior to pumping the wells
* Average of 4 replicates

.ABORATORY TEST SERVICES
CHEMICAL LAB REPORT
ARNOLD ENGINEERING DEVELOPMENT CENTER
ARNOLD AIR FORCE STATION, TENNESSEE 37389

.E.D.C. LANDFILL MONITORING WELLS--QUARTERLY ANALYSIS

.ORK ORDER NO.: 1   A.F. NO.:   AWD NO.: 107408-08

.EQUESTED BY: M.B. KIMBROUGH/490   REPORT NO.: 4042-094C

.ATERIAL SUBMITTED: WELL WATER SAMPLES   DATE COMP.: 30 APR 84

.NALYZE FOR: SEE TABULATION BELOW.   WORK AUTH. NO.: R54D

.ATE IN: 12 APR 84   DATE OUT:

.Y: C. BAKER, J. CONRY, D. MORSE.   NO. OF SAMPLES: 32

.LL NO. & SAMP.NO.	PH	SPECIFIC COND. MMHO/CM	METHYL CHLOROFORM PPB/WT.	TRICHLORO-ETHYLENE PPB/WT.	PERCHLORO-ETHYLENE PPB/WT.	TOC MG/L
1-1	6.9	155	<5	<5	<10	5
1-2	6.8	156	<5	<5	<10	4
1-3	6.8	160	<5	<5	20	7
1-4	6.8	159	<5	<5	<10	5
2-1	6.6	1047	11,440	90,110	117,750	64
2-2	6.6	1036	11,440	92,930	117,775	55
2,3	6.6	1040	11,260	91,520	116,290	65
2-4	6.7	1021	10,210	77,440	119.230	56
3-1	7.3	432	99	9	386	2
3-2	7.3	429	93	9	378	2
3-3	7.3	430	91	9	354	2
3-4	7.3	437	92	9	379	2
4-1	7.0	618	11,123	15	1,325	3
4-2	7.0	619	10,419	13	1,520	3
4-3	7.0	600	10,701	14	1,501	3
4-4	6.9	587	11,123	14	1,674	3
5-1	7.8	250	40	40	1,302	3
5-2	7.9	244	18	40	1,302	3
5-3	7.9	246	17	40	1,341	3
5-4	7.9	246	17	44	1,288	3
6-1	7.5	370	15	4	14	2
6-2	7.4	373	17	7	7	3
6-3	7.4	373	15	8	7	3
6-4	7.4	373	14	4	7	3
7-1	7.2	421	190	2,992	2,548	2
7-2	7.2	416	211	3.062	2,733	2
7-3	7.2	415	202	3,048	2,772	2
7-4	7.3	418	195	3.168	2,867	2
8-1	7.3	429	915	5,914	1.288	2
8-2	7.3	429	924	5,667	1.344	2
8-3	7.3	428	889	5.632	1,330	3
8-4	7.3	426	929	5,702	1,302	2

LABORATORY TEST SERVICES
Laboratory Section Report

Work Order No. 1 AWD No. 10740808
Requested by H.B. Kimbrough, MS-490 Report No. 4042-094C
Material Submitted Sanitary Landfill Well (8) Water Date Completed 22 May 84
Work Auth. 554
Date In 12 April 1984 Date Out 30 May 1984
By J.T. Brown, P.G. Shelton, A.F. Bridges, J.B. Coury

Instructions:

Quarterly AEDC Landfill Well Analyses

Well No.	1	2	3	4	5	6	7	8	
Results: Cr, ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Pb, ppm	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Ag, ppm	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Hg, ppb	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
*NO_3^--N, mg/l	—	44.0	—	—	—	—	—	—	
CN^-, mg/l	< 0.02	0.31	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	
** Well H_2O Level	8'0"	9'5"	2'1"	4'9"	6'1"	8'9"	1'11"	2'9"	1068.4
	1076.3	1071.8	1070.6	(1070.7)	(1070.1)	(1072.2)	(1071.5)	(1069.1)	

Remarks: * Well No, 2 only
** Measured prior to pumping

GC-338 (10/82)

APPENDIX E

MASTER LIST OF SHOPS

APPENDIX E

MASTER LIST OF SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Wastes	Typical TSD Methods
<u>Facility Support</u>				
Data Reproduction	100	yes	no	-
Print Shop	100	yes	yes	DPDO/Sanitary Sewer/Landfill
Carpenter Shop	1478	yes	yes	Landfill/Sanitary Sewer
Paint Shop	1478	yes	yes	DPDO/Landfill
Custodial Services	1478	yes	no	-
Buildings and Grounds	1478	yes	no	-
Pipe Shop	1478	yes	yes	FPTA/Landfill
Refrigeration Shop	1478	yes	yes	DPDO/Landfill
Mech. Maintenance Shop	1478	yes	yes	Sanitary Sewer
Automobile Repair Shop	1400	yes	yes	Steam Plant A/Landfill
Locomotive Repair Shop	1401	yes	yes	Steam Plant A/Landfill
Chemical/Metallurgical Lab	445	yes	yes	DPDO/Sanitary Sewer
X-Ray Lab	2108	yes	yes	Silver Recovery/San. Sewer

APPENDIX E
(Continued)

MASTER LIST OF SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Wastes	Typical TSD Methods
Power Control	1525	yes	yes	DPDO
Sewage Treatment Plant	1552	yes	no	-
Water Treatment Plant	1504	yes	no	-
Test Fuel Farm	869	yes	yes	Steam Plant A/FPTA
Bulk Fuel Farm	1575	yes	yes	Steam Plant A/FPTA
Steam Plant A	1411	yes	no	-
Steam Plant B	535	yes	no	-
Fabrication & Maintenance Shop	451	yes	yes	DPDO/Sanitary Sewer
Structural Maintenance Section	451	yes	yes	DPDO
Central Machine Shop	451	yes	yes	DPDO/Steam Plant A/San. Sewer
Plating and Heat Treat Shop	451	yes	yes	DPDO/Landfill
Equipment Maintenance Shop	451	yes	yes	DPDO/Steam Plant A
Photo Lab	451	yes	yes	Silver Recovery/San. Sewer

APPENDIX E
(Continued)

MASTER LIST OF SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Wastes	Typical TSD Methods
Machine Shop A	640	yes	yes	DPDO/Steam Plant A/San. Sewer
Machine Shop B	690	yes	yes	DPDO/Steam Plant A/San. Sewer
Machine Shop C	760	yes	yes	DPDO/Steam Plant A/San. Sewer
Dispensary	225	yes	yes	Sanitary Sewer
Golf Course	2808 & 2810	yes	no	-
Fire, Police and Communications	251	yes	no	-
Instrumentation Calibration Lab	350	yes	yes	Steam Plant A/Sanitary Sewer
Force, Flow & Dynamics	390	yes	yes	Steam Plant A/Sanitary Sewer
<u>Engine Test Facility</u>				
J1 Test Cell	880	yes	yes	DPDO
J2 Test Cell	880	yes	yes	DPDO
J3 Test Cell	832	yes	yes	DPDO
J4 Test Cell	521	yes	yes	DPDO/Steam Plant A
J5 Test Cell	522	yes	yes	DPDO/Steam Plant A/Landfill

APPENDIX E
(Continued)

MASTER LIST OF SHOPS

Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Wastes	Typical TSD Methods
Air Compressor and Test Bldg.	878	yes	yes	DPDO/Steam Plant A
ETF Exhauster	882	yes	yes	DPDO
Rocket Prep. Area	1690 2201 2210 2215	yes	yes	DPDO
<u>Von Karman Facility</u>				
S Range	320	yes	yes	DPDO
K Range	675	yes	yes	Contract Disposal/DPDO
G Range	678	yes	yes	Contract Disposal/DPDO/ Landfill
Main Compressor Bldg.	651	yes	yes	DPDO/Steam Plant A
Main Test and Lab	676	yes	yes	DPDO/Landfill/Sanitary Sewer
Aerodynamic and Propulsion Test Unit	579	yes	yes	DPDO
VKF Yard Area	676	yes	yes	DPDO/Steam Plant A
Tunnel F	690	yes	yes	DPDO

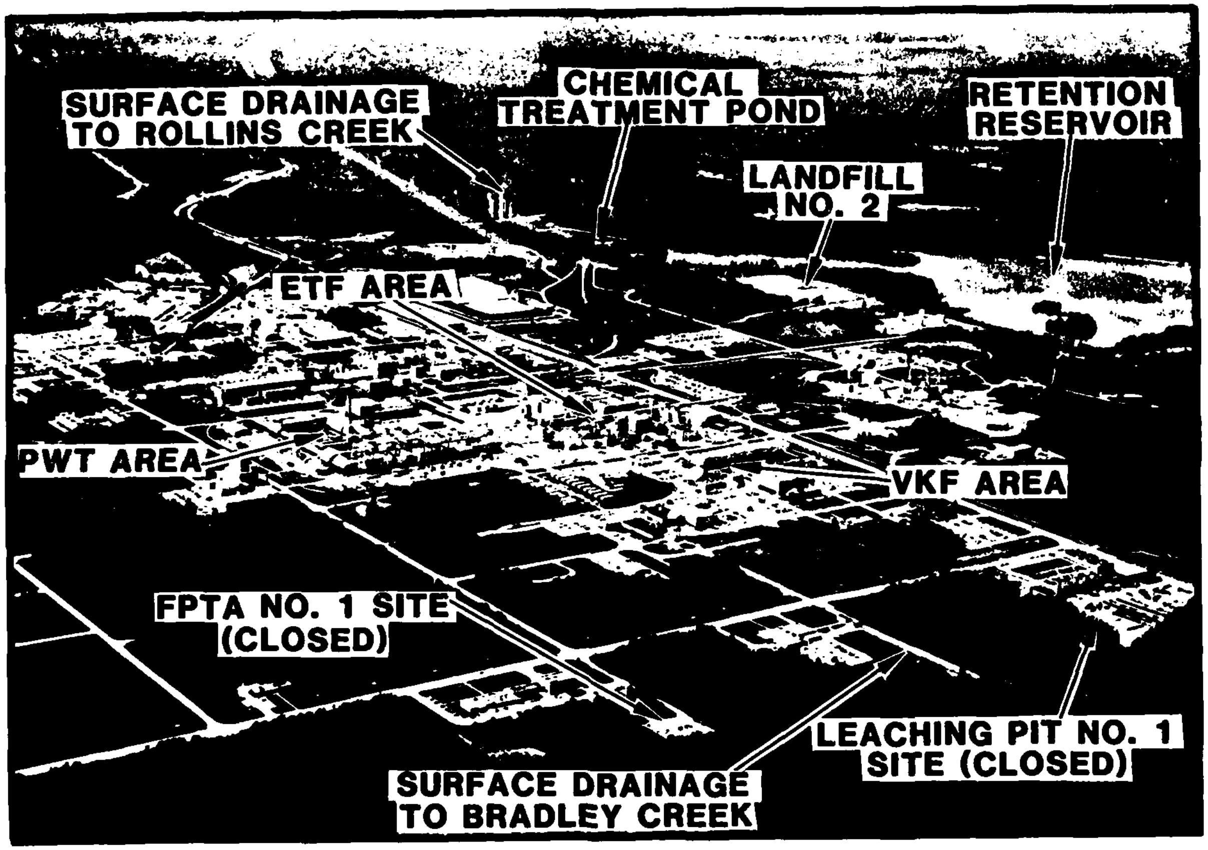
APPENDIX E
(Continued)

MASTER LIST OF SHOPS

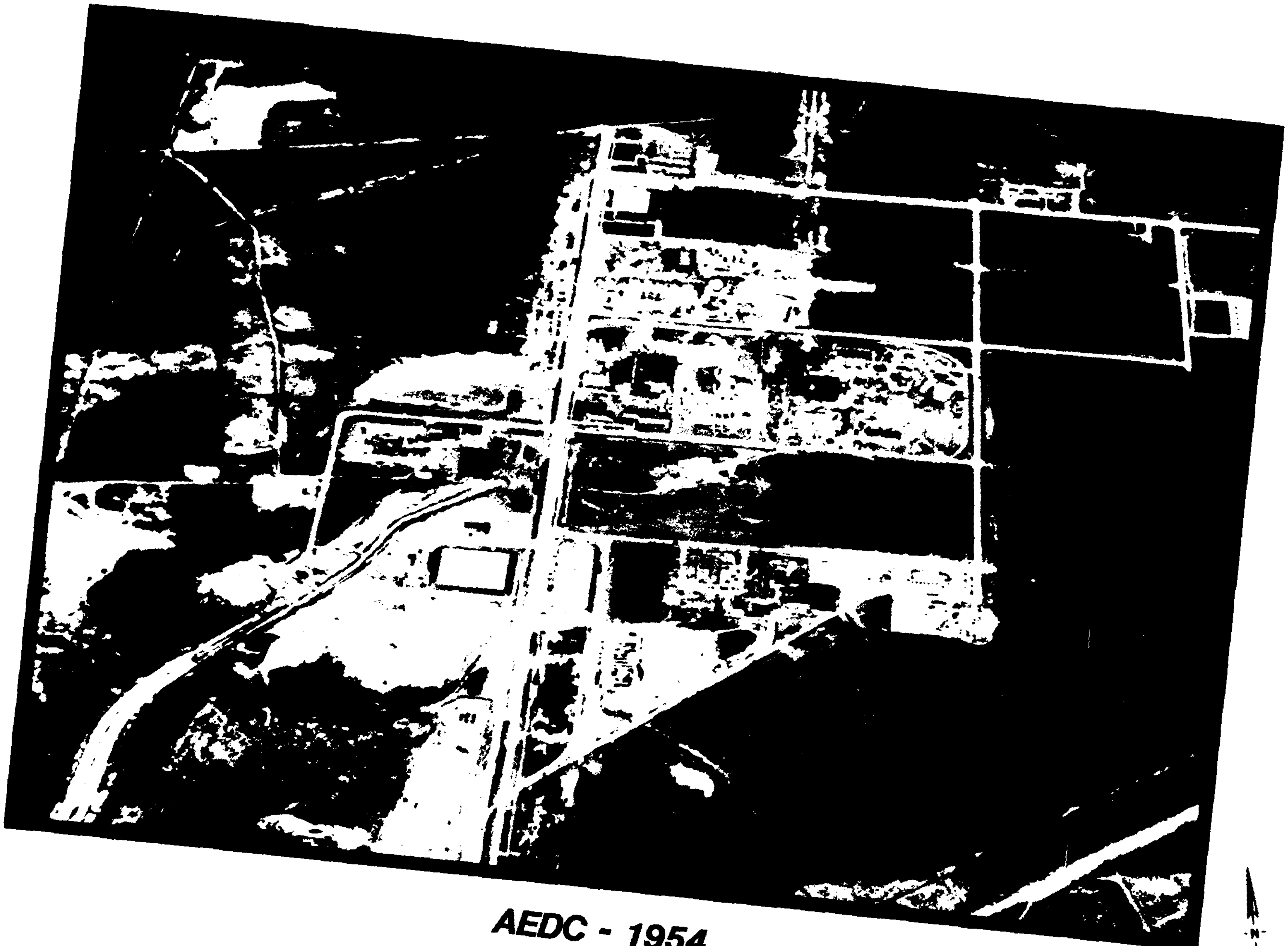
Name	Present Location (Bldg. No.)	Handles Hazardous Materials	Generates Hazardous Wastes	Typical TSD Methods
Mark I	1075	yes	yes	Steam Plant A/DPDO
Engineering Lab	1077	yes	yes	DPDO
Propulsion Wind Tunnel				
Model Installations	760	yes	yes	DPDO/Steam Plant A
16S Tunnel System	745	yes	yes	DPDO/Steam Plant A/Sanitary Sewer
16T Tunnel System	785	yes	yes	DPDO/Steam Plant A/Sanitary Sewer
Motor Drive	780	yes	yes	DPDO/Steam Plant
High Temperature Lab	722	yes	yes	DPDO
(PES) Plenum Evacuation System	710	yes	yes	Steam Plant/Landfill
P-Plant Section	620	yes	yes	DPDO/Sanitary Sewer
V-Plant Section	620	yes	no	-

APPENDIX F

PHOTOGRAPHS

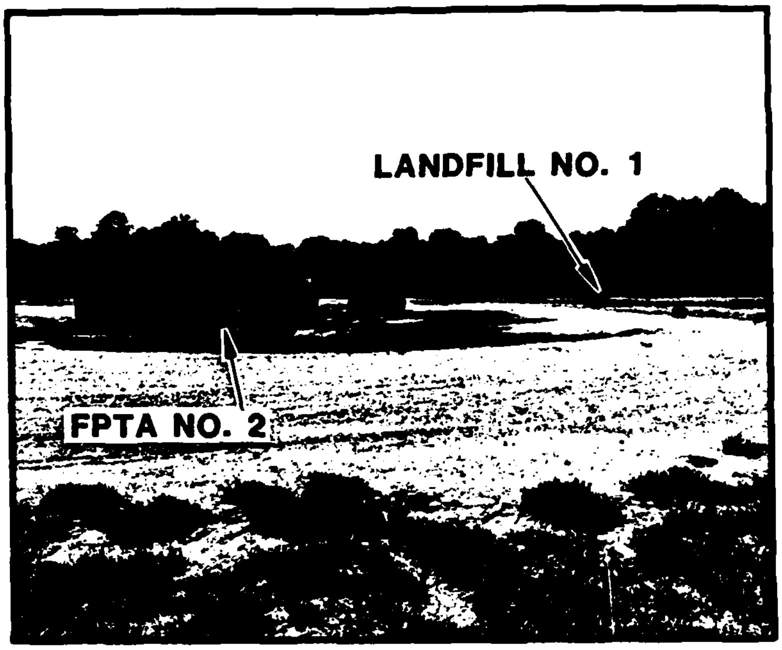


AEDC - Present

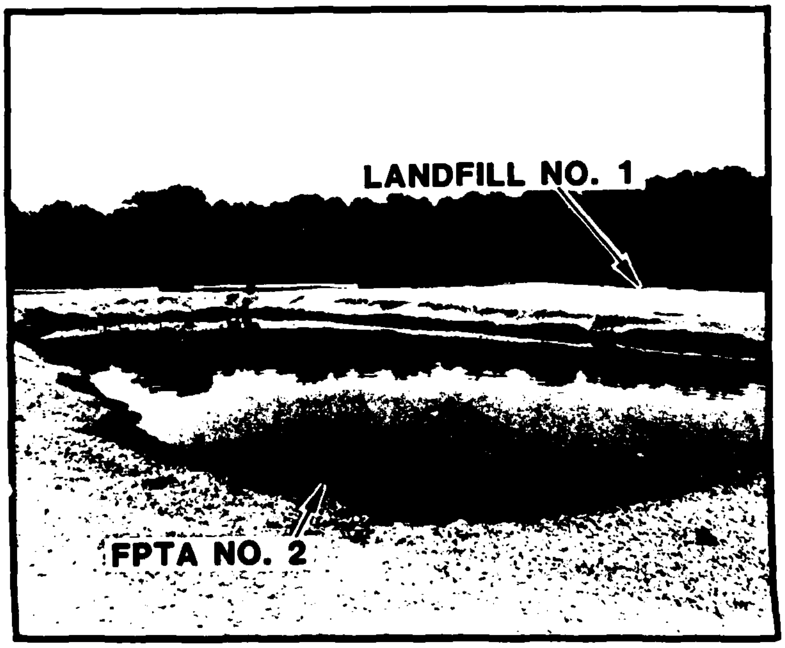


AEDC - 1954

BURN AREA NO. 1 and LANDFILL NO. 1
1966



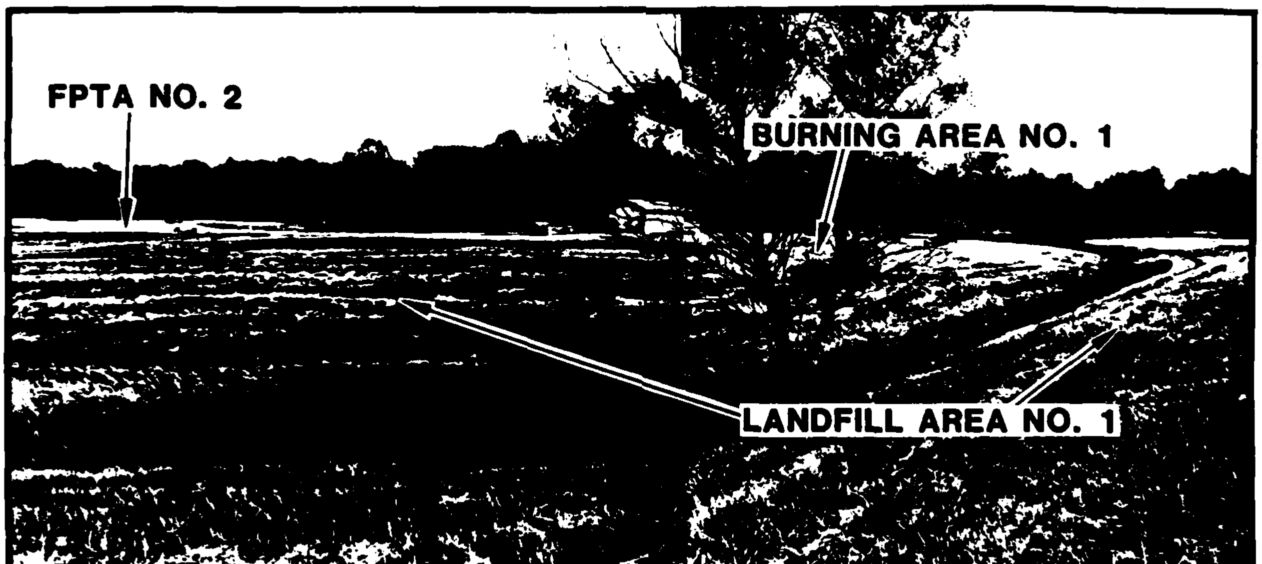
Fire Protection Training Area No. 2
and Landfill Area No. 1
(FACING NORTHWEST)
(1984)



Fire Protection Training Area No. 2
and Landfill Area No. 1
(FACING SOUTHEAST)
(1984)

AEDC

Landfill No. 2 Adjacent to Retention Reservoir
(FACING SOUTHWEST)
(1984)



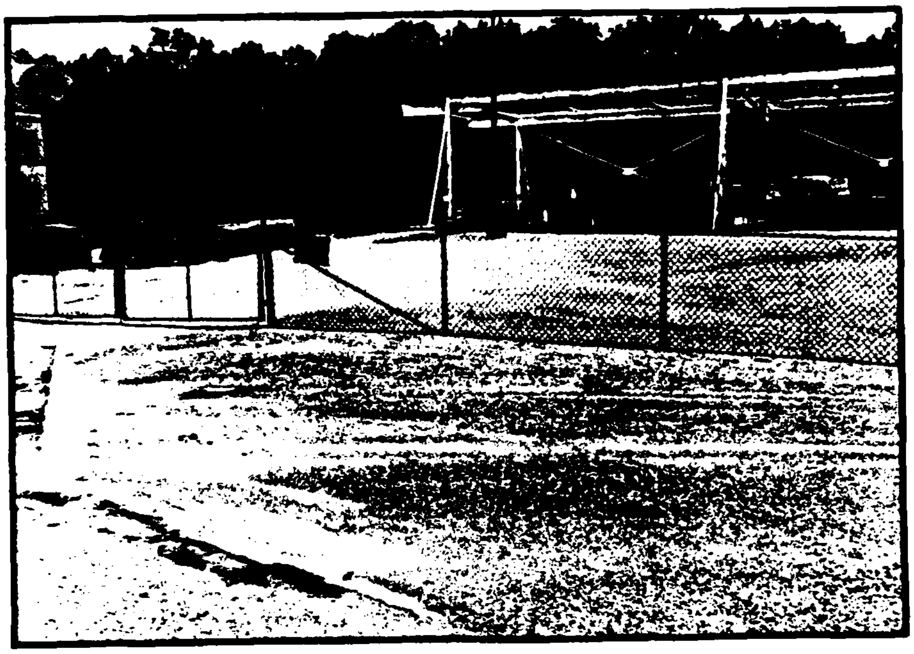
Landfill No. 1 Area, Burning Area No. 1
and Fire Protection Training Area No. 2
(FACING SOUTHEAST)
(1984)

Fire Protection Training Area No. 1
(FACING NORTHWEST)
(1984)

Leaching Pit at Landfill No. 2
Adjacent to Retention Reservoir
(FACING SOUTH)
(1984)

Landfill No. 3 for UTSI
(FACING NORTH)
(1984)

Landfill No. 4 for County-Municipal Wastes
(FACING EAST)
(1984)

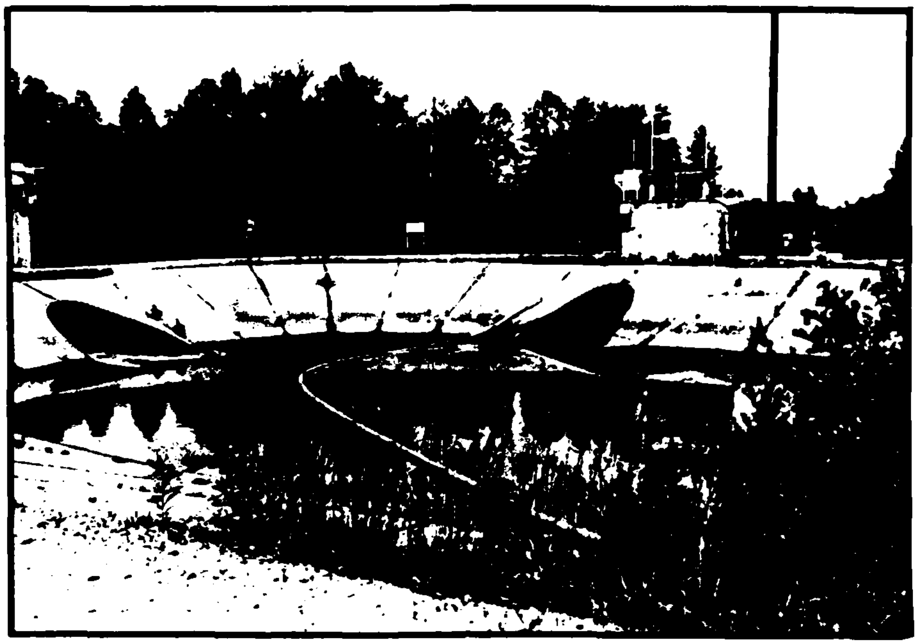


Old Leaching Pit Area and Present Neutralization Facilities Near Model Shop
(FACING NORTH)
(1984)

Waste Disposal at Old Camp Forrest Water Treatment Plant
(1950'S)

Leaching/Burning Pit Near Retention Reservoir
(FACING EAST)
(1984)

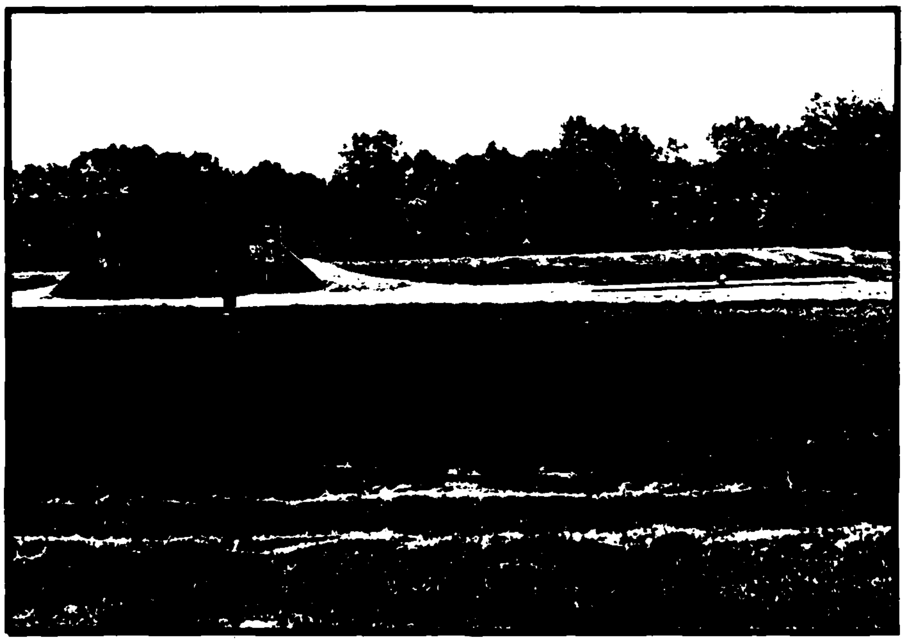
Chemical Unloading Apron for Above Leaching/Burning Pit
(FACING NORTH)
(1984)



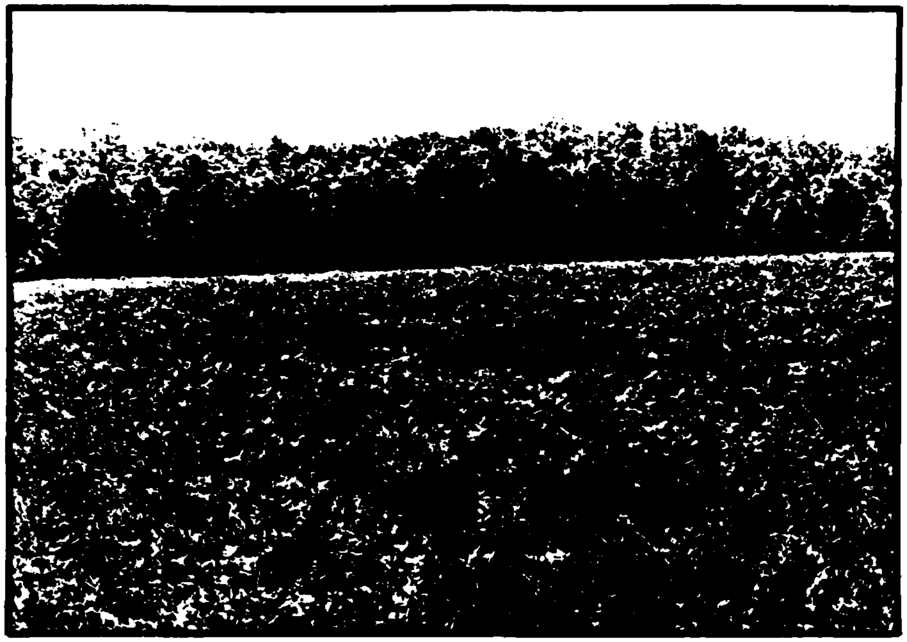
Diversion Structure To/From Cooling Water Return Ditch and Retention Reservoir
(FACING WEST)
(1984)

HEF Container Burial Near Retention Reservoir
(1959-1961)

Chemical Treatment Pond
(FACING SOUTH)
(1984)



Hazardous Waste Accumulation Area (Facility 2220)
(FACING SOUTH)
(1984)



Burn Area at Airfield
(FACING EAST)
(1984)

Leaching Area for Washwater Containing Beryllium
(FACING NORTHWEST)
(1984)

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM

HAZARD ASSESSMENT RATING METHODOLOGY

APPENDIX G

USAF INSTALLATION RESTORATION PROGRAM
HAZARD ASSESSMENT RATING METHODOLOGY

BACKGROUND

The Department of Defense (DOD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DOD facilities. One of the actions required under this program is to:

> "develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts." (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Records Search phase of its Installation Restoration Program (IRP).

The first site rating model was developed in June 1981 at a meeting with represenatives from USAF Occupational and Environmental Health Laboratory (OEHL), Air Force Engineering and Services Center (AFESC), Engineering-Science (ES) and CH2M Hill. The basis for this model was a system developed for EPA by JRB Associates of McLean, Virginia. The JRB model was modified to meet Air Force needs.

After using this model for 6 months at over 20 Air Force installations, certain inadequacies became apparent. Therefore, on January 26 and 27, 1982, representatives of USAF OEHL, AFESC, various major commands, Engineering-Science, and CH2M Hill met to address the inadequacies. The result of the meeting was a new site rating model designed to present a better picture of the hazards posed by sites at Air Force installations. The new rating model described in this presentation is referred to as the Hazard Assessment Rating Methodology.

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air Force in setting priorities for follow-on site investigations and confirmation work under Phase II of the IRP.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DOD program needs.

The model uses data readily obtained during the Records Search portion (Phase I) of the IRP. Scoring judgments and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards at the site. This approach meshes well with the policy for evaluating and setting restrictions on excess DOD properties.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: the possible receptors of the contamination, the waste and its characteristics, potential pathways for waste contaminant migration, and any efforts to contain the contaminants. Each of these categories contains a number of rating factors that are used in the overall hazard rating.

The receptors category rating is calculated by scoring each factor, multiplying by a factor weighting constant and adding the weighted scores to obtain a total category score.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among three possible routes is used. These routes are surface water migration, flooding, and ground-water migration. Evaluation of each route involves factors associated with the particular migration route. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The waste characteristics category is scored in three steps. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The scores for each of the three categories are then added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Sites at which there is no containment are not reduced in score. Scores for sites with limited containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

FIGURE 1

HAZARD ASSESSMENT RATING METHODOLOGY FLOW CHART

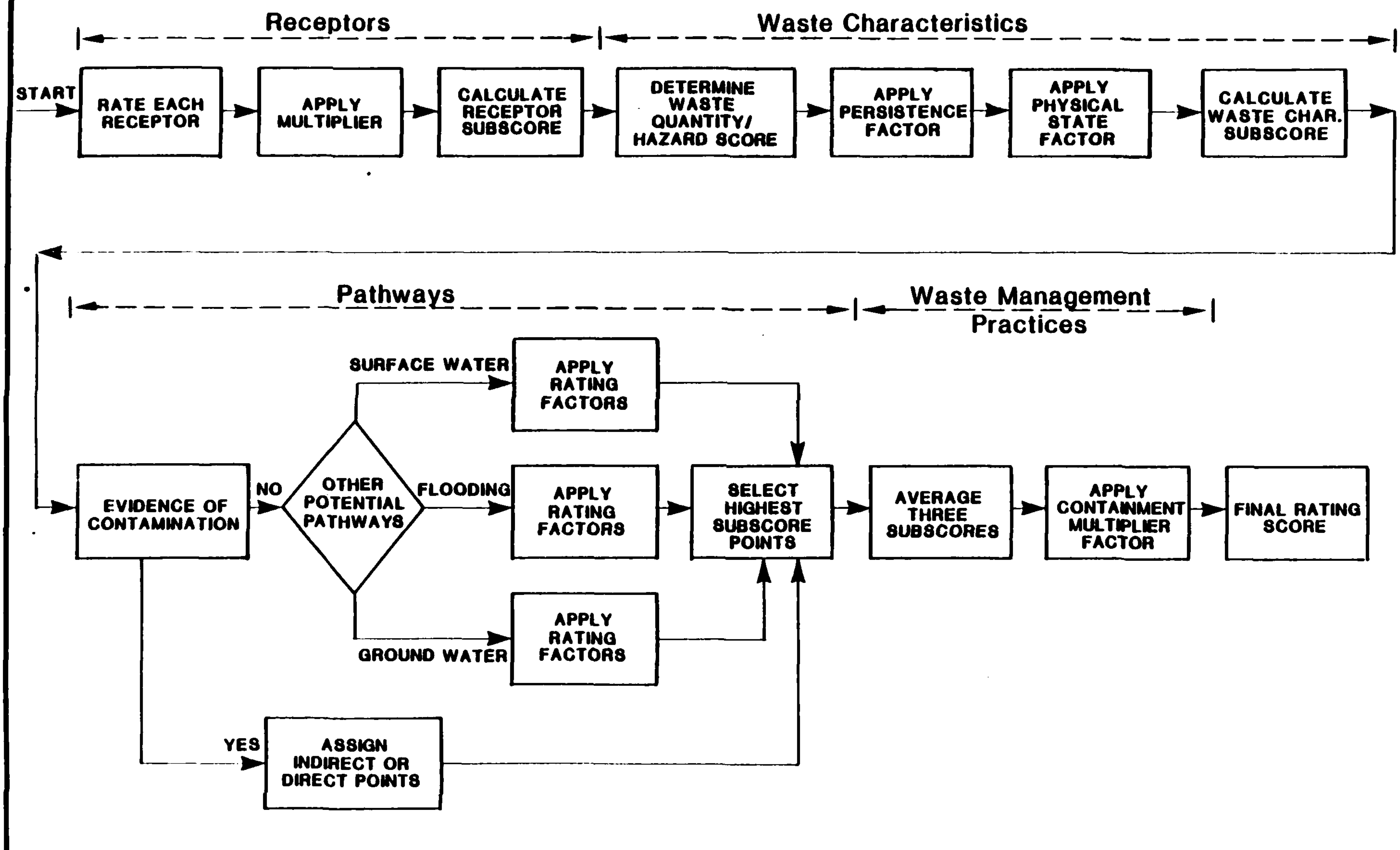


FIGURE 2

HAZARD ASSESSMENT RATING METHODOLOGY FORM

NAME OF SITE ____________________

LOCATION ____________________

DATE OF OPERATION OR OCCURRENCE ____________________

OWNER/OPERATOR ____________________

COMMENTS/DESCRIPTION ____________________

SITE RATED BY ____________________

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site		4		
B. Distance to nearest well		10		
C. Land use/zoning within 1 mile radius		3		
D. Distance to reservation boundary		6		
E. Critical environments within 1 mile radius of site		10		
F. Water quality of nearest surface water body		6		
G. Ground water use of uppermost aquifer		9		
H. Population served by surface water supply within 3 miles downstream of site		6		
I. Population served by ground-water supply within 3 miles of site		6		
		Subtotals	______	______

Receptors subscore (100 X factor score subtotal/maximum score subtotal) ______

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (S = small, M = medium, L = large) ______
2. Confidence level (C = confirmed, S = suspected) ______
3. Hazard rating (H = high, M = medium, L = low) ______

Factor Subscore A (from 20 to 100 based on factor score matrix) ______

B. Apply persistence factor
Factor Subscore A X Persistence Factor = Subscore B

______ X ______ = ______

C. Apply physical state multiplier

Subscore B X Physical State Multiplier = Waste Characteristics Subscore

______ X ______ = ______

FIGURE 2 (Continued)

III. PATHWAYS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore ______

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating, and proceed to C.

1. Surface water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Distance to nearest surface water		8		
Net precipitation		6		
Surface erosion		8		
Surface permeability		6		
Rainfall intensity		8		

Subtotals ______ ______

Subscore (100 X factor score subtotal/maximum score subtotal) ______

2. Flooding

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Flooding		1		

Subscore (100 x factor score/3) ______

3. Ground-water migration

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
Depth to ground water		8		
Net precipitation		6		
Soil permeability		8		
Subsurface flows		8		
Direct access to ground water		8		

Subtotals ______ ______

Subscore (100 x factor score subtotal/maximum score subtotal) ______

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore ______

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors ______
Waste Characteristics ______
Pathways ______

Total ______ divided by 3 = ______
Gross Total Score

B. Apply factor for waste containment from waste management practices

Gross Total Score X Waste Management Practices Factor = Final Score

______ X ______ = ______

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (<5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (>20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records.
- o Knowledge of types and quantities of wastes generated by shops and other areas on base.
- o Based on the above, a determination of the types and quantities of waste disposed of at the site.

S = *Suspected confidence level*

- o *No verbal reports* or conflicting verbal reports and no written information from the *records*.
- o *Logic* based on a knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site.

A-3 Hazard Rating

Hazard Category	*Rating Scale Levels* 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200°F	Flash point at 140°F to 200°F	Flash point at 80°F to 140°F	Flash point less than 80°F
Radioactivity	At or below *background* levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

TABLE 1

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1 - 25	26 - 100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1 mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1 mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence of economically important natural resources susceptible to contamination.	Major habitat of an endangered or threatened species; presence of recharge area; major wetlands.	10
F. Water quality/use designation of nearest surface water body	Agricultural or industrial use.	Recreation, propagation and management of fish and wildlife.	Shellfish propagation and harvesting.	Potable water supplies	6
G. Ground-Water use of uppermost aquifer	Not used, other sources readily available.	Commercial, industrial, or irrigation, very limited other water sources.	Drinking water, municipal water available.	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available.	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1 - 50	51 - 1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1 - 50	51 - 1,000	Greater than 1, 000	6

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

II. WASTE CHARACTERISTICS (Continued)

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
80	L	C	M
	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	M
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:
For a site with more than one hazardous waste, the waste quantities may be added using the following rules:
Confidence Level
- o Confirmed confidence levels (C) can be added
- o Suspected confidence levels (S) can be added
- o Confirmed confidence levels cannot be added with suspected confidence levels

Waste Hazard Rating
- o Wastes with the same hazard rating can be added
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be directly confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 POTENTIAL FOR SURFACE WATER CONTAMINATION

Rating Factor	Rating Scale Levels: 0	1	2	3	Multiplier
Distance to nearest surface water (includes drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 in.	-10 to + 5 in.	+5 to +20 in.	Greater than +20 in.	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1 year 24-hr rainfall	<1.0 inch	1.0-2.0 inches	2.1-3.0 inches	>3.0 inches	8

B-2 POTENTIAL FOR FLOODING

Rating Factor	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 25-year floodplain	In 10-year floodplain	Floods annually	1

B-3 POTENTIAL FOR GROUND-WATER CONTAMINATION

Rating Factor	0	1	2	3	Multiplier
Depth to ground water	Greater than 500 ft	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 in.	-10 to +5 in.	+5 to +20 in.	Greater than +20 in.	6
Soil permeability	Greater than 50% clay ($>10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($<10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8
Direct access to ground water (through faults, fractures, faulty well casings, subsidence fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

TABLE 1 (Continued)

HAZARD ASSESSMENT RATING METHODOLOGY GUIDELINES

IV. **WASTE MANAGEMENT PRACTICES CATEGORY**

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. **WASTE MANAGEMENT PRACTICES FACTOR**

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Proection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1 or III-B-3, then leave blank for calculation of factor score and maximum possible score.

APPENDIX H

SITE HAZARD RATING FORMS

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Landfill No. 2 / Leaching Pit No. 2
Location: Adjacent to Retention Reservoir and Wastewater Treatment Plant
Date of Operation or Occurrence: Landfill - 1956 to Present; Leaching Pit - 1950's to 1979
Owner/Operator: AEDC
Comments/Description: Disposed acids, caustics, propellant equipment, metal salts, solvents, pesticides, oils, paints, thinners, etc. Sites rated together due to adjacent location.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			72	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 40

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			80	108
Subscore (100 x factor score subtotal/maximum score subtotal)				74
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	2	8	16	24
Direct access to ground water	0	8	0	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	40		
Waste Characteristics	100		
Pathways	100		
Total 240 divided by 3 =		80	Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

80 x 1.00 = 80

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Retention Reservoir/J-4 Area -- Surface Drainage
Location: Adjacent to Chemical Treatment Pond, Landfill No. 2 and Liquid Fuels Storage
Date of Operation or Occurrence: Reservoir - 1959 to Present; Drainage - 1965 to Present
Owner/Operator: AEDC
Comments/Description: Retains/pretreats oils, propellant residuals, petroleum fuels, toulene, etc. Surface drainage leading directly to Reservoir rated jointly due to location.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			68	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 100

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			80	108
Subscore (100 x factor score subtotal/maximum score subtotal)				74
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to ground water	0	8	0	24
Subtotals			68	114
Subscore (100 x factor score subtotal/maximum score subtotal)				60

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 100

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		38
Waste Characteristics		100
Pathways		100
Total	238	divided by 3 = 79 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

79 x 1.00 = \ 79 \

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Landfill No. 4
Location: NW corner AEDC Reservation near Manchester, TN.
Date of Operation or Occurrence: 1971 - Present
Owner/Operator: Owner - AEDC; Operator - Coffee Co., Manchester and Tullahoma, TN.
Comments/Description: Disposal of municipal wastes, metal salts, solvents, acids, and refuse from AEDC (since 1980)
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	3	3	9	9
D. Distance to reservation boundary	3	6	18	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			107	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 59

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			80	108
Subscore (100 x factor score subtotal/maximum score subtotal)				74
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 74

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		59		
Waste Characteristics		100		
Pathways		74		
Total	233	divided by 3 =	78	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

78 x 1.00 = 78

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage - Bradley Creek
Location: Drainage course leading N. E. and then S. from AEDC through skimming pond.
Date of Operation or Occurrence: 1953 - Present
Owner/Operator: AEDC
Comments/Description: Receives spills/leaks and runoff from the Model Shop Area, Leaching Pit No. 1 and AEDC test facilities (mainly VKF and part of ETF)
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multiplier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	3	10	30	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			89	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 49

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	NA	1	NA	NA
Subscore (100 x factor score/3)				NA
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	49		
Waste Characteristics	100		
Pathways	69		
Total	218 divided by 3 =	73	Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

73 x 1.00 = 73

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage - Rollins Creek
Location: Drainage course leading SW. from AEDC; Can direct/receive waters to/from Retention Reservoir
Date of Operation or Occurrence: 1953 - Present
Owner/Operator: AEDC
Comments/Description: Receives spills/leaks, runoffs, and cooling water returns from major portion of AEDC test facilities. Recieves discharges Retention Reservoir, Chemical Treatment Pond, and Main Wastewater Treatment Plant.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	0	6	0	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	3	6	18	18
Subtotals			78	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 43

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscc e A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	NA	1	NA	NA
Subscore (100 x factor score/3)				NA
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		43
Waste Characteristics		100
Pathways		69
Total	212	divided by 3 = 71 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

71 x 1.00 = 71

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Old Camp Forest Water Treatment Plant
Location: About 3/4 mi. S. of AEDC access highway and 6 mi. W. of AEDC
Date of Operation or Occurrence: 1953 - 1980
Owner/Operator: AEDC
Comments/Description: Burning and disposal of propellants, solvents, oils, and contaminated containers, drums, piping, etc.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi- plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	0	3	0	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			64	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium , 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	2	8	16	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			80	108
Subscore (100 x factor score subtotal/maximum score subtotal)				74
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 74

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		36		
Waste Characteristics		100		
Pathways		74		
Total	210	divided by 3 =	70	Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

70 x 1.00 = \ 70 \

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Testing Areas (VKF, ETF, and PWT) Spills and Leaks
Location: Third and Fourth Streets between Mark I and J-4
Date of Operation or Occurrence: 1953 - Present
Owner/Operator: AEDC
Comments/Description: Rating for spills/leaks of oils, solvents, etc. to ground areas (not spills or leaks to sanitary or storm systems)
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground water supply within 3 miles of site	1	6	6	18
Subtotals			76	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		42		
Waste Characteristics		100		
Pathways		67		
Total	209	divided by 3 =	70	Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

70 x 1.00 = 70

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Leaching Pit No. 1
Location: Behind Model Shop - Building 451
Date of Operation or Occurrence: 1953 - 1972
Owner/Operator: AEDC
Comments/Description: Acid, caustic, detergents, metal solutions to pit

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			76	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 1.00 = 100

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

100 x 1.00 = 100

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors	42		
Waste Characteristics	100		
Pathways	67		
Total 209	divided by 3 =	70	Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

70 x 1.00 = 70

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage - Brumalow Creek
Location: Drainage course leading S. from AEDC through skimming pond.
Date of Operation or Occurrence: 1953 - Present
Owner/Operator: AEDC
Comments/Description: Receives spills/leaks and runoff from the PWT test area, motor pool, steam plant, etc.

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	2	4	8	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	0	6	0	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	3	6	18	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			90	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 50

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) s
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 1.00 = 70

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

70 x 1.00 = 70

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	NA	1	NA	NA
Subscore (100 x factor score/3)				NA
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		50
Waste Characteristics		70
Pathways		69
Total	189	divided by 3 = 63 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

63 x 1.00 = 63

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 2/Burn Area No. 1/Landfill No. 1
Location: Near Gate 5: NW of Model Shop
Date of Operation or Occurrence: FPTA - 1973 to Present; Burn Area and Landfill - 1953 to 1970
Owner/Operator: AEDC
Comments/Description: Sites rated together since they are adjacent or on top of each other. Burned and disposed of oils, thinners, petroleum fuels, propellants, metal scrap, power plant ash, etc.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			68	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		38		
Waste Characteristics		80		
Pathways		67		
Total	185	divided by 3 =	62	Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

62 x 1.00 = 62

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Chemical Treatment Pond
Location: Adjacent to and S. of Retention Reservoir
Date of Operation or Occurrence: 1961 - 1982
Owner/Operator: AEDC
Comments/Description: Propellants and toulene treated/disposed

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			68	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	3	8	24	24
Direct access to ground water	0	8	0	24
Subtotals			68	114
Subscore (100 x factor score subtotal/maximum score subtotal)				60

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		38	
Waste Characteristics		80	
Pathways		67	
Total	185	divided by 3 =	62 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

62 x 1.00 = 62

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Retention Leach / Burn Area
Location: S. of Retention Reservoir Dam
Date of Operation or Occurrence: 1950's - 1960's
Owner/Operator: AEDC
Comments/Description: Area for leaching and burning propellants and toluene

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			64	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 100

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

100 x 0.80 = 80

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

80 x 1.00 = 80

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		36	
Waste Characteristics		80	
Pathways		69	
Total	185 divided by 3 =		62 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

62 x 1.00 = 62

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Fire Protection Training Area No. 1
Location: Behind Fire Dept. - Building 257
Date of Operation or Occurrence: 1953 - 1983
Owner/Operator: AEDC
Comments/Description: Most fires off ground on steel "pan"; burned oils, magnesium, petroleum fuels, propellants, etc.
Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	3	4	12	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			76	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 42

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) m
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 80

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

80 x 0.80 = 64

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

64 x 1.00 = 64

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.

Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		42	
Waste Characteristics		64	
Pathways		67	
Total	173	divided by 3 =	58 Gross total score

B. Apply factor for waste containment from waste management practices.

Gross total score x waste management practices factor = final score

58 x 1.00 = 58

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Surface Drainage - Crumpton Creek
Location: Drainage course leading W. from AEDC
Date of Operation or Occurrence: 1953 - Present
Owner/Operator: AEDC
Comments/Description: Receives leakage from Retention Reservoir Dam

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	0	6	0	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			61	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 34

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) 1
2. Confidence level (1=confirmed, 2=suspected) s
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 70

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

70 x 0.80 = 56

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

56 x 1.00 = 56

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	NA	1	NA	NA
Subscore (100 x factor score/3)				NA
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	1	8	8	24
Direct access to ground water	0	8	0	24
Subtotals			60	114
Subscore (100 x factor score subtotal/maximum score subtotal)				53

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		34
Waste Characteristics		56
Pathways		69
Total	159	divided by 3 = 53 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

53 x 1.00 = \ 53 \

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: HEF Burn / Burial Area
Location: West side of Retention Reservoir in vicinity of Retention Leach / Burn Area
Date of Operation or Occurrence: 1959 - 1961
Owner/Operator: AEDC
Comments/Description: One time detonation and burning of HEF containers in trench

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			64	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 36

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) s
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 1.00 = 48

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	3	8	24	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	1	6	6	18
Rainfall intensity	3	8	24	24
Subtotals			74	108
Subscore (100 x factor score subtotal/maximum score subtotal)				69
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	3	8	24	24
Net precipitation	2	6	12	18
Soil permeability	2	8	16	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			52	114
Subscore (100 x factor score subtotal/maximum score subtotal)				46

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 69

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		36
Waste Characteristics		48
Pathways		69
Total	153	divided by 3 = 51 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

51 x 1.00 = 51

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Beryllium Leaching Area
Location: Adjacent to Building 1697; E. of Chemical Treatment Pond
Date of Operation or Occurrence: 1963 - 1967
Owner/Operator: AEDC
Comments/Description: Water from washing machines used for Beryllium contaminated clothes

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	1	4	4	12
B. Distance to nearest well	1	10	10	30
C. Land use/zoning within 1 mile radius	2	3	6	9
D. Distance to reservation boundary	1	6	6	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	1	6	6	18
Subtotals			68	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 38

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) s
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 1.00 = 60

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

60 x 0.50 = 30

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	1	8	8	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			72	108
Subscore (100 x factor score subtotal/maximum score subtotal)				67
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 67

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		38	
Waste Characteristics		30	
Pathways		67	
Total	135	divided by 3 =	45 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

45 x 1.00 = 45

HAZARD ASSESSMENT RATING METHODOLOGY FORM

Name of Site: Burn Area No. 2
Location: E. and S.E. of AEDC Airfield
Date of Operation or Occurrence: 1983
Owner/Operator: AEDC
Comments/Description: One time burning of solid rocket fuel

Site Rated by: R. L. Thoem

I. RECEPTORS

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
A. Population within 1,000 feet of site	0	4	0	12
B. Distance to nearest well	2	10	20	30
C. Land use/zoning within 1 mile radius	1	3	3	9
D. Distance to reservation boundary	2	6	12	18
E. Critical environments within 1 mile radius of site	3	10	30	30
F. Water quality of nearest surface water body	1	6	6	18
G. Ground water use of uppermost aquifer	0	9	0	27
H. Population served by surface water supply within 3 miles downstream of site	0	6	0	18
I. Population served by ground-water supply within 3 miles of site	2	6	12	18
Subtotals			83	180

Receptors subscore (100 x factor score subtotal/maximum score subtotal) 46

II. WASTE CHARACTERISTICS

A. Select the factor score based on the estimated quantity, the degree of hazard, and the confidence level of the information.

1. Waste quantity (1=small, 2=medium, 3=large) s
2. Confidence level (1=confirmed, 2=suspected) c
3. Hazard rating (1=low, 2=medium, 3=high) h

Factor Subscore A (from 20 to 100 based on factor score matrix) 60

B. Apply persistence factor
Factor Subscore A x Persistence Factor = Subscore B

60 x 0.80 = 48

C. Apply physical state multiplier
Subscore B x Physical State Multiplier = Waste Characteristics Subscore

48 x 0.50 = 24

III. PATHWAYS

A. If there is evidence of migration of hazardous contaminants, assign maximum factor subscore of 100 points for direct evidence or 80 points for indirect evidence. If direct evidence exists then proceed to C. If no evidence or indirect evidence exists, proceed to B.

Subscore 0

B. Rate the migration potential for 3 potential pathways: surface water migration, flooding, and ground-water migration. Select the highest rating and proceed to C.

Rating Factor	Factor Rating (0-3)	Multi-plier	Factor Score	Maximum Possible Score
1. Surface Water Migration				
Distance to nearest surface water	2	8	16	24
Net precipitation	2	6	12	18
Surface erosion	0	8	0	24
Surface permeability	2	6	12	18
Rainfall intensity	3	8	24	24
Subtotals			64	108
Subscore (100 x factor score subtotal/maximum score subtotal)				59
2. Flooding	0	1	0	3
Subscore (100 x factor score/3)				0
3. Ground-water migration				
Depth to ground water	2	8	16	24
Net precipitation	2	6	12	18
Soil permeability	1	8	8	24
Subsurface flows	0	8	0	24
Direct access to ground water	0	8	0	24
Subtotals			36	114
Subscore (100 x factor score subtotal/maximum score subtotal)				32

C. Highest pathway subscore.
Enter the highest subscore value from A, B-1, B-2 or B-3 above.

Pathways Subscore 59

IV. WASTE MANAGEMENT PRACTICES

A. Average the three subscores for receptors, waste characteristics, and pathways.

Receptors		46	
Waste Characteristics		24	
Pathways		59	
Total	129 divided by 3 =		43 Gross total score

B. Apply factor for waste containment from waste management practices.
Gross total score x waste management practices factor = final score

43 x 1.00 = 43

APPENDIX I

GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

APPENDIX I
GLOSSARY OF TERMINOLOGY AND ABBREVIATIONS

AEDC: Arnold Engineering Development Center

AEROZINE: A propellant with a 50-50 blend of hydrazine and UDMH; referred to as AZ-50.

AF: Air Force.

AFCS: Air Force Communications Service.

AFFF: Aqueous Film Forming Foam, a fire extinquishing agent.

AFS: Air Force Station.

AFSC: Air Force Systems Command.

Ag: Chemical symbol for silver.

Al: Chemical symbol for aluminum.

ALLUVIUM: Materials eroded, transported and deposited by streams.

ALLUVIAL FAN: A fan-shaped deposit formed by a stream either where it issues from a narrow mountain valley into a plain or broad valley, or where a tributary stream joins a main stream.

ARTESIAN: Ground water contained under hydrostatic pressure.

AQUIFER: A geologic formation, group of formations, or part of a formation that is capable of yielding water to a well or spring.

AVGAS: Aviation Gasoline.

AZ-50: Aerozine, a propellant.

Ba: Chemical symbol for barium.

BAROMETRIC WELL: A sump containing water which separates a test cell at vacuum from atmospheric pressure permitting cooling water to be drained from the vacuum test cell to the well.

BIOACCUMULATE: Tendency of elements or compounds to accumulate or build up in the tissues of living organisms when they are exposed to these elements in their environments, e.g., heavy metals.

Cd: Chemical symbol for cadmium.

CE: Civil Engineering.

CERCLA: Comprehensive Environmental Response, Compensation and Liability Act.

CHIPS: Term used to define recyclable metal turnings or shavings.

CIRCA: About; used to indicate an approximate date.

CLOSURE: The completion of a set of rigidly defined functions for a hazardous waste facility no longer in operation.

CN: Chemical symbol for cyanide.

COD: Chemical Oxygen Demand, a measure of the amount of oxygen required to oxidize organic and oxidizable inorganic compounds in water.

COE: Corps of Engineers.

CONFINED AQUIFER: An aquifer bounded above and below by impermeable strata or by geologic units of distinctly lower permeability than that of the aquifer itself.

CONFINING UNIT: An impermeable or poorly permeable layer which restricts the movement of ground water.

CONTAMINATION: The degradation of natural water quality to the extent that its usefulness is impaired; there is no implication of any specific limits since the degree of permissible contamination depends upon the intended end use or uses of the water.

Cr: Chemical symbol for chromium.

Cu: Chemical symbol for copper.

DIP: The angle at which a stratum is inclined from the horizontal.

DISPOSAL FACILITY: A facility or part of a facility at which hazardous waste is intentionally placed into or on land or water, and at which waste will remain after closure.

DISPOSAL OF HAZARDOUS WASTE: The discharge, deposit, injection, dumping, spilling, or placing of any hazardous waste into or on land or water so that such waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground water.

DOD: Department of Defense.

DOWNGRADIENT: In the direction of decreasing hydraulic static head; the direction in which ground water flows.

DPDO: Defense Property Disposal Office.

DUMP: An uncovered land disposal site where solid and/or liquid wastes are deposited with little or no regard for pollution control or aesthetics; dumps are susceptible to open burning and are exposed to the elements, disease vectors and scavengers.

EFFLUENT: A liquid waste discharge from a manufacturing or treatment process, in its natural state, or partially or completely treated, that discharges into the environment.

EOD: Explosive Ordnance Disposal.

EP: Extraction Procedure, the EPA's standard laboratory procedure for leachate generation.

EPA: U.S. Environmental Protection Agency.

EROSION: The wearing away of land surface by wind, water, or chemical processes.

ES: Engineering-Science.

ETF: Engine Test Facility.

FACILITY (AS APPLIED TO HAZARDOUS WASTES): Any land and appurtenances thereon and thereto used for the treatment, storage and/or disposal of hazardous wastes.

FAULT: A fracture in rock along which the adjacent rock surfaces are differentially displaced.

Fe: Chemical symbol for iron.

FLOW PATH: The direction or movement of ground water as governed principally by the hydraulic gradient.

FPTA: Fire Protection Training Area.

FT: Fire Training Area.

GC/MS: Gas chromatograph/mass spectrophotometer, a laboratory procedure for identifying unknown compounds.

GROUND WATER: Water beneath the land surface in the saturated zone that is under atmospheric or artesian pressure.

GROUND WATER RESERVOIR: The earth materials and the intervening open spaces that contain ground water.

HALF-LIFE: The time required for half the atoms present in radioactive substance to disintegrate.

HARDFILL: Disposal sites receiving construction debris, wood, miscellaneous spoil material.

HARM: Hazard Assessment Rating Methodology.

HAZARDOUS SUBSTANCE: Under CERCLA, the definition of hazardous substance includes:

1. All substances regulated under Paragraphs 311 and 307 of the Clean Water Act (except oil);

2. All substances regulated under Paragraph 3001 of the Solid Waste Disposal Act;

3. All substances regulated under Paragraph 112 of the Clean Air Act;

4. All substances which the Administrator of EPA has acted against under Paragraph 7 of the Toxic Substance Control Act;

5. Additional substances designated under Paragraph 102 of the Superfund bill.

HAZARDOUS WASTE: As defined in RCRA, a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

HAZARDOUS WASTE GENERATION: The act or process of producing a hazardous waste.

He: Chemical symbol for helium.

HEAVY METALS: Metallic elements, including the transition series, which include many elements required for plant and animal nutrition in trace concentrations but which become toxic at higher concentrations.

HEF: High energy fuel; an alkyl borane fuel.

Hg: Chemical symbol for mercury.

HOTSHOT TYPE WIND TUNNEL: A wind tunnel wherein the discharge of an electric arc heats a capsule of test gas to high pressure and temperature thus causing a diaphragm to rupture and allow test gas to expand through a nozzle into the tunnel test section.

HQ: Headquarters.

HTH: A strong chlorine oxidizing agent.

HWMF: Hazardous Waste Management Facility.

HYDRAZINE: A propellant (N_2H_4); a strong reducing agent which reacts with carbon dioxide and oxygen in air resulting in spontaneous ignition.

HYPERSONIC: Speeds of five or more times the speed of sound.

INCOMPATIBLE WASTE: A waste unsuitable for commingling with another waste or material because the commingling might result in generation of extreme heat or pressure, explosion or violent reaction, fire, formation of substances which are shock sensitive, friction sensitive, or otherwise have the potential for reacting violently, formation of toxic dusts, mists, fumes, and gases, volatilization of ignitable or toxic chemicals due to heat generation in such a manner that the likelihood of contamination of ground water or escape of the substance into the environment is increased, any other reaction which might result in not meeting the air, human health, and environmental standards.

INFILTRATION: The movement of water through the soil surface into the ground.

IRP: Installation Restoration Program.

J-4: Rocket test cell.

JP-4: Jet Propulsion Fuel Number Four, contains both kerosene and gasoline fractions.

JP-5: Jet Propulsion Fuel Number Five; consists of high boiling kerosene fractions.

LEACHATE: A solution resulting from the separation or dissolving of soluble or particulate constituents from solid waste or other man-placed medium by percolation of water.

LEACHING: The process by which soluble materials in the soil, such as nutrients, pesticide chemicals or contaminants, are washed into a lower layer of soil or are dissolved and carried away by water.

LENTICULAR: A bed or rock stratum or body that is lens-shaped.

LH: Liquid Hydrogen.

LINER: A continous layer of natural or man-made materials beneath or on the sides of a surface impoundment, landfill, or landfill cell which restricts the downward or lateral escape of hazardous waste, hazardous waste constituents or leachate.

LN_2: Liquid Nitrogen.

LOX: Liquid Oxygen.

LO_2: Liquid Oxygen

MACH NUMBER: A number representing the ratio of the speed of a body to the speed of sound in the surrounding medium.

MARK I: Aerospace environmental chamber capable of testing full-scale spacecraft.

MEK: Methyl Ethyl Ketone.

MGD: Million Gallons per Day.

MMH: Monomethylhydrazine - propellant.

MOGAS: Motor gasoline.

Mn: Chemical symbol for manganese.

MONITORING WELL: A well used to measure ground-water levels and to obtain samples.

Mr/hr: Millirem/hour; a measure of radioactivity.

MSL: Mean Sea Level.

NAK: Sodium potassium alloy, a liquid metal.

NDI: Non-destructive Inspection.

NET PRECIPITATION: The amount of annual precipitation minus annual evaporation.

NGVD: National Geodetic Vertical Datum of 1929.

N_2H_4: Hydrazine

Ni: Chemical symbol for nickel.

N_2O_4: Nitric Oxide or Nitrogen Tetroxide.

NPDES: National Pollutant Discharge Elimination System.

OEHL: Occupational and Environmental Health Laboratory.

OPEN LOOP WIND TUNNEL: Nonrecirculating wind tunnel; exhaust characteristically discharges to atmosphere or other volume, makeup air supplied by machinery or high pressure source.

OPNS: Operations.

ORGANIC: Being, containing or relating to carbon compounds, especially in which hydrogen is attached to carbon.

OSI: Office of Special Investigations.

O&G: Symbols for oil and grease.

OXIDIZER: Material necessary to support combustion of fuel.

Pb: Chemical symbol for lead.

PCB: Polychlorinated Biphenyl; liquids used as a dielectrics in electrical equipment.

PERCOLATION: Movement of moisture by gravity or hydrostatic pressure through interstices of unsaturated rock or soil.

PERMEABILITY: The capacity of a porous rock, soil or sediment for transmitting a fluid without damage to the structure of the medium.

pH: Negative logarithm of hydrogen ion concentration.

PLENUM CHAMBER: A cavity which can be excavated allowing part of the wind tunnel air stream to be removed through perforated wall.

POL: Petroleum, Oils and Lubricants.

POLLUTANT: Any introduced gas, liquid or solid that makes a resource unfit for a specific purpose.

POTENTIOMETRIC SURFACE: The imaginery surface to which water in an aquifer would rise in tightly screened wells penetrating it.

PPB: Parts per billion by weight.

PPM: Parts per million by weight.

PRECIPITATION: Rainfall.

PROPELLANT: Fuels, oxidizers and monopropellants.

PWT: Propulsion Wind Tunnel.

QUATERNARY MATERIALS: The second period of the Cenozoic geologic era, following the Tertiary, and including the last 2-3 million years.

RCRA: Resource Conservation and Recovery Act.

RECHARGE AREA: A surface area in which surface water or precipitation percolates through the unsaturated zone and eventually reaches the zone of saturation. Recharge areas may be natural or manmade.

RECHARGE: The addition of water to the ground-water system by natural or artificial processes.

RFNA: Red Fuming Nitric Acid.

RP-1: Rocket Propulsion Number One, high boiling kerosene fractions.

SANITARY LANDFILL: A land disposal site using an engineered method of disposing solid wastes on land in a way that minimizes environmental hazards.

SATURATED ZONE: That part of the earth's crust in which all voids are filled with water.

SCS: U.S. Department of Agriculture Soil Conservation Service.

SLUDGE: The solid residue resulting from a manufacturing or wastewater treatment process which also produces a liquid stream. The residue which accumulates in liquid fuel storage tanks.

SOLID WASTE: Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, or agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage; solid or dissolved materials in irrigation return flows; industrial discharges which are point source subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended (86 USC 880); or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954 (68 USC 923).

SPILL: Any unplanned release or discharge of a hazardous waste onto or into the air, land, or water.

STORAGE OF HAZARDOUS WASTE: Containment, either on a temporary basis or for a longer period, in such a manner as not to constitute disposal of such hazardous waste.

STP: Sewage Treatment Plant.

SUBSONIC: Speeds less than the speed of sound.

SUPERSONIC: Speeds of from one to five times the speed of sound.

TCA: 1,1,1,-Tetrachloroethane.

TCE: Trichloroethylene.

TDS: Total Dissolved Solids.

TEA: Triethylaluminum - a propellant.

TEB: Triethylboron - a propellant.

TOC: Total Organic Carbon.

TOXICITY: The ability of a material to produce injury or disease upon exposure, ingestion, inhalation, or assimilation by a living organism.

TRANSMISSIVITY: The rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient.

TRANSONIC: Speeds approximating the speed of sound.

TREATMENT OF HAZARDOUS WASTE: Any method, technique, or process including neutralization designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize the waste or so as to render the waste nonhazardous.

TSD: Treatment, storage or disposal.

UDMH: Unsymmetrical dimethylhydrazine, a propellant.

UPGRADIENT: In the direction of increasing hydraulic static head; the direction opposite to the prevailing flow of ground-water.

USAF: United States Air Force.

USFWS: United States Fish and Wildlife Service.

USGS: United States Geological Survey.

VARSOL: Also called mineral or petroleum spirits; a volatile clear non-fluorescent liquid. Properties include boiling point 40 to 80°C; flash point less than 0°F, lower explosion limit 1.1%; upper explosion limit 5.9%; density .65 to .66; auto ignition limit 550°F; and vapor density of 2.5.

VKF: Von Karman Facility.

WATER TABLE: Surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.

WWTP: Wastewater Treatment Plant.

Zn: Chemical symbol for zinc.

APPENDIX K

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TO POTENTIAL CONTAMINATION SITES AT AEDC

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